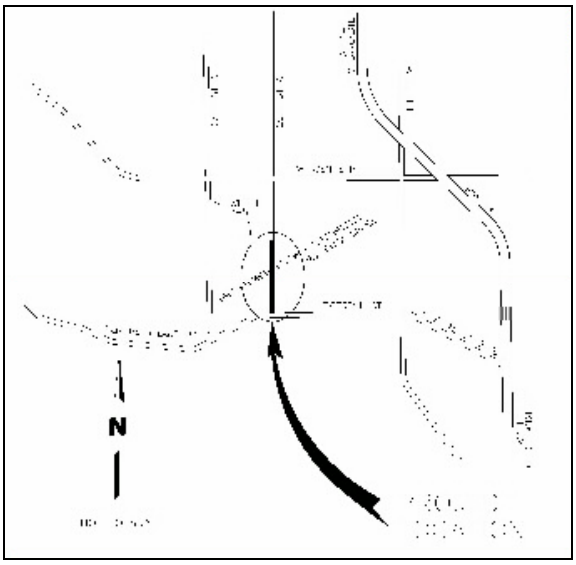
Appendix B

City of Palmdale
20th Street West - Amargosa Creek Improvements
Project Number: 484

PROJECT REPORT



On : 20th Street West
From : Elizabeth Lake Road
To : Avenue P-8

REVIEWED:

_____ _____
David Wu, Project Manager Date
City of Palmdale

_____ _____
Bill Padilla, City Traffic Engineer Date
City of Palmdale

_____ _____
Mike Mischel, City Engineer Date
City of Palmdale

RECOMMENDED:

_____ _____
Timothy W. Hughes Date
Deputy Director of Public Works
City of Palmdale

APPROVED:

_____ _____
Leon Swain, P.E. Date
Director of Public Works
City of Palmdale

This Project Report has been prepared under the direction of the following registered civil engineer. The registered civil engineer attests to the technical information contained herein and the engineering data upon which recommendations, conclusions, and decisions are based.

_____ _____

James Faber, P.E. Date
Project Manager

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INTRODUCTION

EXECUTIVE SUMMARY

The City of Palmdale, proposes to extend 20th Street West southerly, from its existing northern terminus at Avenue P-8, across Amargosa Creek, to Elizabeth Lake Road, where a new traffic signal is to be installed (hereinafter referred as "the project"). The total project length is 0.5 miles (refer to Attachments A and B for exhibits showing the project improvements).

The project will construct 20th Street West from an unpaved road to four-lane, secondary arterial, with a combination of a raised and a striped median, and will include a bridge overcrossing of Amargosa Creek, with undercrossing bike paths on both banks of the creek. The bridge will be aesthetically enhanced by adding architectural features.

The project also includes improvements to the Amargosa Creek Channel alignment, a paved soil-cement invert upstream and downstream of the crossing, and slope protection. These improvements are based upon the City's approved plans for the improvements to Amargosa Creek, Project SD 02-58, and the City's Master Plan of Drainage.

The project cost is included as Attachment F, and is estimated to be $8.0 million on March 6, 2007, which includes $0.3 million for right of way acquisition; $1.2 million for design engineering and construction management; and $6.5 million for construction. The project is mainly locally funded by local funds.

The Project objectives are to:
1. Implement roadway improvements consistent with the City's General Plan.
2. Implement improvements that will enhance traffic safety, circulation and operations by providing connection from Elizabeth Lake Road to Avenue P-8.
3. Implement roadway improvements consistent with the future development within the area.
4. Protect the natural resources associated with the Amargosa Creek.
5. Reduce the impact to existing residential properties.

The Project improvements will include:

- Approximately 0.5 miles of a new four-lane roadway from existing Quick Street to Elizabeth Lake Road.
- Approximately 0.1 miles of two-lane roadway pavement, an extension of Bradcliff Road to join proposed 20th Street West.
- Over 4000 linear feet of curb, gutter and sidewalk, and approximately 300 linear feet of raised median.
- An 80 feet wide bridge, spanning 120 feet across the Amargosa Creek.
- Two bike paths, undercrossing the proposed bridge structure, with retaining walls along the banks of Amargosa Creek.
- The modification of the Amargosa Creek invert upstream and downstream of the proposed overcrossing.
- The acquisition of approximately 0.63 acres of right of way, and 0.56 acres of slope easement.
- The installation of a new traffic signal at the 20th Street West/ Elizabeth Lake Road Intersection.
- Street drainage improvements, including installation of drainage inlets, lateral pipes, and an extension of a 36" RCP.
- Other minor improvements.

RECOMMENDATION

This Project Report (PR) recommends it's accompanying Initial Study/Mitigated Negative Declaration (IS/MND), which is the Final CEQA Environmental Document (ED), be approved. Environmental Clearance for NEPA is not required, and therefore not included.

This PR also recommends the approval of the Preferred Alternative (refer to Attachment B), which is discussed in greater detail in Section 5, and proceeding to the design phase.

BACKGROUND

PROJECT HISTORY

The proposed project was identified in the City's 2005 Ten-Year Capital Improvement Program as Project No. STR053. The City of Palmdale's 2005 Ten-Year Capital Improvement Plan (CIP) is comprised of 239 proposed projects categorized into:

1. Drainage.
2. General City.
3. Parks and Recreation.
4. Streets.
5. Traffic.

These projects conform to the goals, objectives, and policies of the elements of the General Plan, and the program was approved by the Planning Commission on April 11, 2005.

20th Street West – Amargosa Creek Improvement is under Category 4 of said program. Funding for the project is from developer's fees supplemented by the City's General Fund.

COMMUNITY INTERACTION

The Project Development Team (PDT) for the Project includes representatives from the City of Palmdale and the California Department of Fish and Game. These representatives have been active participants with regard to the engineering and environmental studies leading to the development of this PR and the IS/MND.

EXISTING FACILITY

The existing facility can be considered as an unpaved road on native ground, with no crossing at Amargosa Creek. The following image depicts the aerial view of the project site:

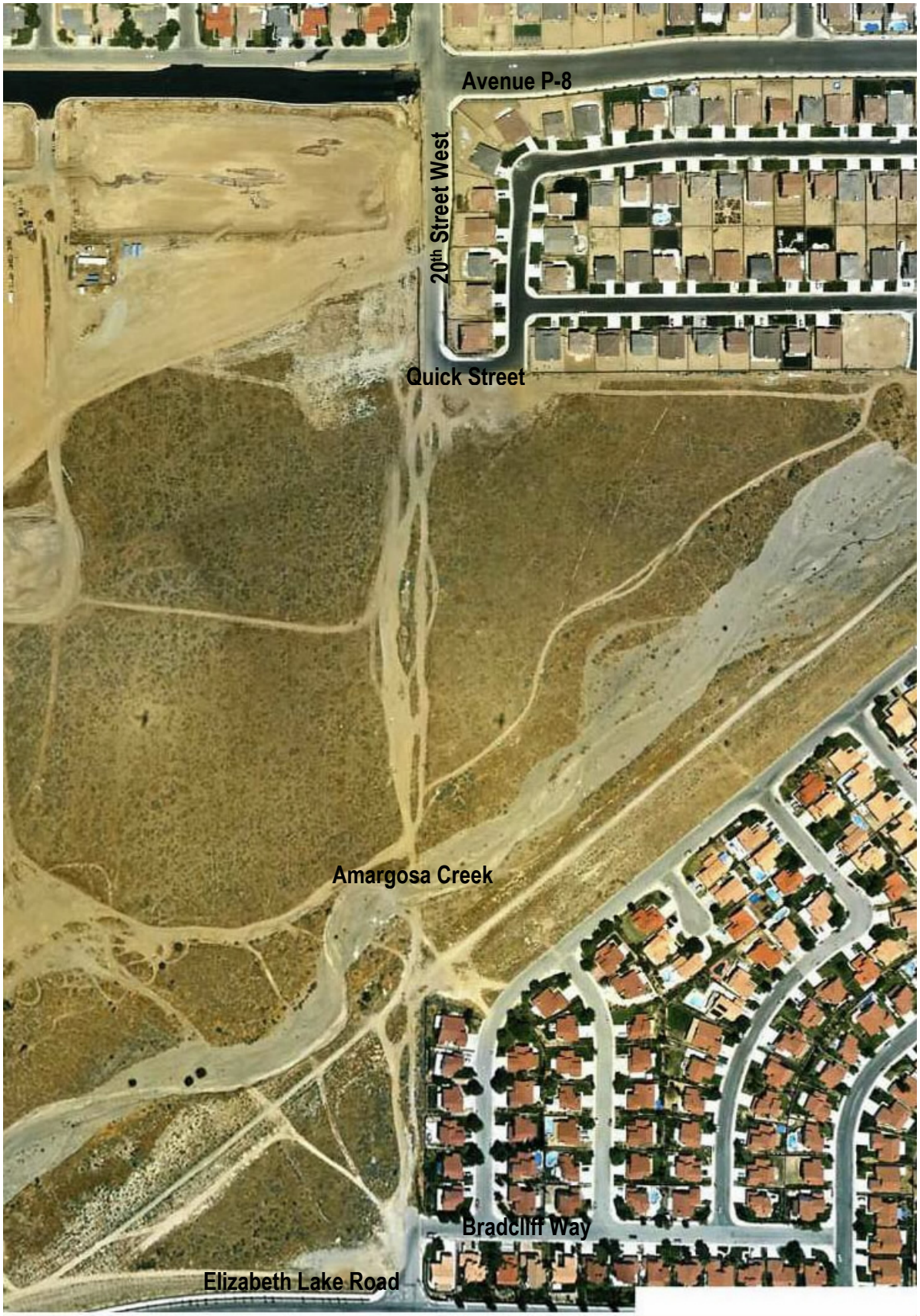


Figure 1: Aerial View of Project Site

Roadway

As mentioned previously, the existing roadway is an unpaved, rough-graded, roadway linking the north end and south end pavements, and is not used by the traveling public. Occasionally, maintenance vehicles are able to access the creek channel.

The paved portion of existing 20th Street West intersects with the following local streets within the project limits:

- Avenue P-8 (non-signalized).
- Quick Street (non-signalized).
- Bradcliff Way (non-signalized).
- Elizabeth Lake Road (non-signalized).

Figure 2: South End of Project, Looking North

Figure 3: North End of Project, Looking North

Utilities

The project site is still at the early phase of the urbanization, and covers mostly vacant and undeveloped land. Therefore, there are limited utilities within the region. The primary utilities features are the following:

- Southern California overhead lines running north/ south at east side of the existing roadway.
- Southern California gas line running north/ south at east side of the existing roadway.
- Palmdale Water District Sewer line running along the Amargosa Creek.

Please refer to Attachment C for a map of the existing utilities within the project area.

Drainage

Amargosa Creek serves as a major drainage facility at the project vicinity. The existing creek is an earthen channel with an unlined, natural streambed. Currently, the City of Palmdale Public Works Department is improving the Amargosa Creek by realigning the centerline of the creek and constructing a soil cement channel between 10th Street West and 20th Street West. Two hydrologic and hydraulic design reports have been prepared by Pacific Advanced Civil Engineering, Inc. (PACE) dated April 2003 (Revised August 2003) and June 2003, from which these improvements are documented.

There are no major existing drainage features along the existing 20th Street West alignment. However, there will be a future 36" RCP constructed along east of 20th Street West, from Elizabeth Lake Road to Amargosa Creek. The 36" RCP drainage system terminates at the creek with a bubble-out box structure outlet within the Ctiy's right-of-way (see Attachment D for 36" RCP layout). Drainage improvements, specifically for the Preferred Alternative, are further discussed in Section 5.1.2., Drainage, of this report.

Geotechnical

Attachment L is the Geotechnical Investigation Report for the project, which documents the existing site conditions within the project area, and includes recommendations for structural foundations and roadway typical sections.

NEED AND PURPOSE

PROBLEM, DEFICIENCIES, JUSTIFICATION

As mentioned in previously, 20th Street West serves as a secondary north/south arterial in the City of Palmdale; however, it exists as an unpaved, rough-graded, roadway between Quick Street to the north and Bradcliff Way to the south. The area around 20th Street West has grown significantly with residential development, and because of this growth 20th Street West is expected to be an essential transportation corridor for the surrounding region. Currently, traffic traveling south on 20th Street West to Elizabeth Lake has to detour through Avenue P and 25th Street West due to the discontinuity of 20th Street West at Amargosa Creek. As a result, this traffic movement is depositing more vehicular volume on Avenue P, which already carries a high volume of traffic.

Several sub-division plans have been submitted to City for developing land on the north side of Amargosa Creek along the existing 20th Street West alignment. The residential occupancy is expected to increase significantly in the near future. The availability of a more accessible route, crossing the creek within the project vicinity, will become a challenge, and a necessity, to the City in order to accommodate the rapid residential growth rate in the region. The project, by constructing a new road and overcrossing of the creek, will provide continuous passage from Avenue P-8 to Elizabeth Lake Road, resulting in a direct and vital solution to congestion within the developed area.

Given the transportation significance of the street, the proposed project is deemed required by the City of Palmdale.

REGIONAL & SYSTEM PLANNING

Local, Regional General Plans

As mentioned previously, the project is: considered a secondary arterial improvement; is consistent with City of Palmdale's General Plan; and is included in the City's 2005 Ten-Year Capital Improvement Program (CIP) as a street improvement project.

The proposed project is also consistent with the local needs created by the future residential development.

TRAFFIC

Since the roadway is identified by, and the project is consistent with, the City's General Plan, a traffic study is not required for this, or future phases of project.

DESCRIPTION AND ISSUES

PREFERRED ALTERNATIVE

For this project, the PDT worked very diligently to identify the locally preferred alternative, which can be found in Attachment B, and in so doing took into account the constraints presented by the project area, and the City's desired features. The constraints affecting the roadway alignment were: the roadway design speed; the impact on the existing residential areas; and consistency with future development. These constraints, and how they were utilized in the development of the preferred alternative, are discussed in the following paragraphs. The City's desired improvements include an overcrossing structure, channel improvements, a signalized intersection, arterial street improvements, a raised median, turning pockets, access roads, sidewalks, and bikepaths. The following paragraphs give a discussion of the preferred alternative.

Roadway

As mentioned previously, the project will construct a new four (4) lane, secondary arterial, with a raised/ striped median, from Quick Street to Elizabeth Lake Road. The project will also install a new signal at the intersection of Elizabeth Lake Road/20th Street West, including a pedestrian crossing. The street improvements will include concrete curb and gutter and sidewalks. The crosswalks, sidewalks, and curb-ramps will be constructed within ADA compliance.

The horizontal and vertical alignments were developed using a design speed of 60 mph, as directed by the City's Traffic Engineer. However, the vertical alignment, where it departs from Elizabeth Lake Road (between station 10+50 and 11+50) does not meet the 60 mph design speed, but rather it meets 50 mph, because the stopping sight distance at the curve is less than 570 feet. This situation is acceptable to the City, since the roadway is approaching/ leaving an intersection, where the vehicles travel speed is reduced.

Horizontally, going north from Elizabeth Lake Road, the Project proposes to shift the existing roadway centerline approximately 50 feet westerly in order to provide the roadway geometry to attain the desired design speed. This roadway shift also provides area for the roadway embankment grading and creates extra space between the new 20th Street West and the adjacent homes for the landscaping features. Further north, where the 20th Street West crosses Amargosa Creek, the horizontal alignment is shifted easterly back to its existing alignment, connecting at the existing intersection with Quick Street.

Geometrical Approval Drawings (GAD) containing of Plan, Profile and Typical Sections of the proposed roadway have been submitted to City for review, and were approved on April 7, 2006.

There are total of three T-intersections along the proposed major roadway. The intersections at Bradcliff Way and Quick Street will be stop controlled intersections, while the intersection at Elizabeth Lake Road will have new signal and turning pockets to facilitate the traffic movements. A concrete raised median will be installed from the intersection of Elizabeth Lake Road for length of 210 feet, terminating north of the intersection with Bradcliff Way. The purpose of the raised median is to restrict traffic left-turns into and out of Bradcliff Way, since both intersections are in close proximity to one another. Additionally, there will be a future T-intersection constructed after the residential development, located on the northwest quadrant of the existing Amargosa Creek/ 20th Street West crossing, is completed. The project will include a left-turn pocket for future access into this development.

The proposed 20th Street West striped median, from Station 24+00 to 30+00 (north of Amargosa Creek), will be striped to accommodate two-way left turn lane movements in the future, as necessary, thereby providing access to the land east of 20th Street West, north of the creek.

Drainage

Amargosa Creek Improvement

As mentioned previously, City of Palmdale, Public Works Department is improving the Amargosa Creek by constructing a soil cement channel between 10th Street West and 20th Street West. Existing, ultimate, and interim condition hydraulics were evaluated by PACE in their April/August 2003 study for Amargosa Creek between 20th Street West (not including the proposed 20th Street West bridge of this project) and 10th Street West. Our study of the project included interim and ultimate conditions in the vicinity of 20th Street West bridge. For details of modeling, please refer to Attachment K, Hydraulic Report for 20th Street Bridge over Amargosa Creek.

The channel design concept in the vicinity of the 20th Street West Bridge consists of transitioning from a trapezoidal channel to a smaller, compound, rectangular channel to accommodate access roads/ bike paths on both sides of the channel. The channel cross section transitions from a trapezoidal channel, with a top width of 95 feet, to rectangular channel, with a top width of 63 feet, then to 46 feet underneath the bridge. Please see Figures 4 & 5 for the conceptual channel layout and the cross sections.

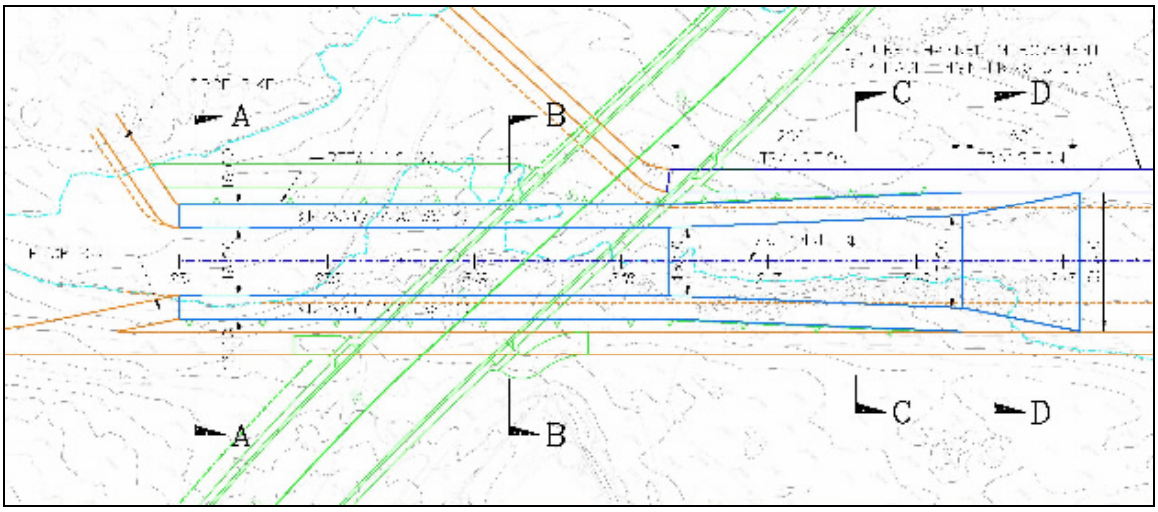


Figure 4: Conceptual Amargosa Creek Upstream Channel Improvement at Proposed 20th Street Bridge

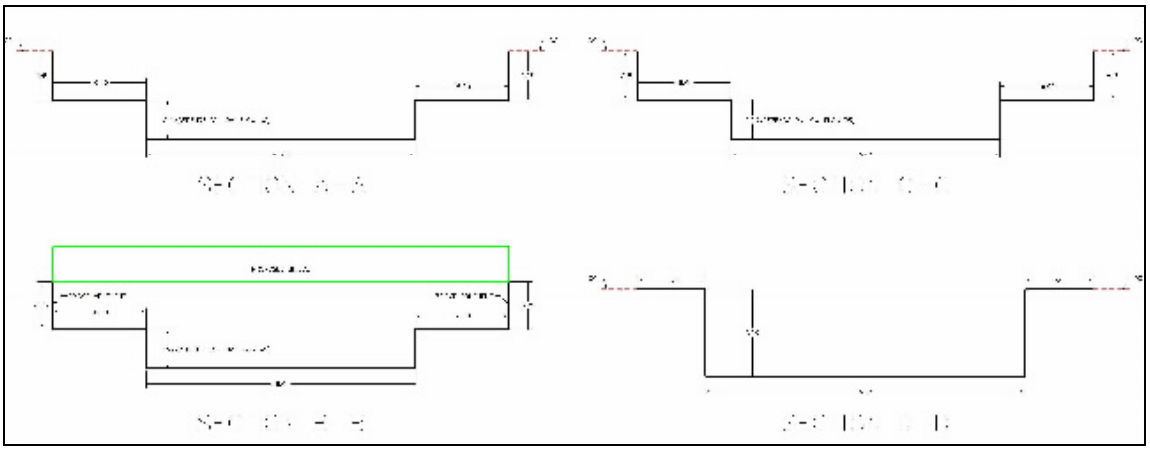


Figure 5: Cross-sections of Upstream Channel Improvement at Proposed 20th Street Bridge

The narrowing of the channel at 20th Street West reduces the bridge span length, resulting in a more cost effective design. The low chord elevation of the bridge has been established with a minimum clearance of 8.25 feet along the access roads/ bike paths under the bridge.

Recommended On-Site Drainage Improvement

As discussed in section 3.1.3, the existing project site has no major drainage facilities, and a 36" RCP easterly of existing 20th Street West alignment will be constructed prior to this project. During this project phase, a preliminary on-site drainage study was performed, and this study recommended a new drainage system be installed within the proposed improvements of 20th Street West.

Since the proposed 20th Street West will be improved with curb and gutter, all the on-site street runoff within the project limit is assumed to be picked up by the proposed drainage facilities. Attachment D shows the proposed catch basin locations where the street runoff is to be collected. Catch basin No. 1 will generally intercept flow generated from the north half of Elizabeth Lake Road that will drain onto improved 20th Street West. Catch basin Nos. 2 and 3 will be installed to intercept street runoff along the gutters generated from the newly paved 20th Street West, south of the overcrossing structure. Catch basin Nos. 4 and 5 will be installed at the sag point on the both sides of Bradcliff Way. North of Amargosa Creek, the street runoff will be carried by the gutters and drain to inlets located at Avenue P-8. A cross gutter will be constructed at the intersection of 20th Street/Quick Street to provide continuous conveyance of the street flow. There will be 18" lateral RCP pipes to connect the catch basins to the future 36" storm drain pipe (constructed by others), which carries the drainage to the bubble-up structure at Amargosa Creek. The proposed design capacity of the catch basins and lateral pipes meet the engineering standards of the City of Palmdale, these being to convey the minimum 10-year and 25-year storm volumes.

The future constructed drainage bubble-up outlet structure at Amargosa Creek is proposed to be demolished, and extended with a new 36" RCP to continuously carry the storm water draining into an outlet structure at the upstream improvement of Amargosa Ceek.

During the study of the project on-site drainage system, the engineering design standards of the City of Palmdale and the standards used by the LA County Hydrology and Hydraulic Manuals were used to calculate time of concentration, storm volumes, size of catch basins, and size of drainage pipes. A hydrology and hydraulic summary table is shown on Attachment D, and the preliminary estimate for the drainage improvement is listed in the below table.

The estimated cost of drainage improvements:

Item Description	**Quantity**	**Unit**	**Unit Price**	**Total**
Construct 18" RCP	475	LF	$150	$ 71,250
Construct 36" RCP Extension	208	LF	$200	$ 41,600
Construct Junction Structure	5	EA	$400	$ 2,000
Construct Catch Basin	5	EA	$1000	$ 5,000
Construct Outlet Structure	1	EA	$500	$ 500
SubTotal				$ 120,350
Contingency (25%)				$30,088
Contingency (15%)				$ 150,438

Utilities

The project is not expected to affect underground utilities. However, there is one Southern California Edison overhead pole within the channel improvement of the project at the Amargosa Creek, and another single pole located at the proposed raised roadway northeast of Amargosa Creek, which may need to be relocated. Please refer to Attachment C. Several other poles and power lines run parallel to the project, and these may infringe on the proposed roadway embankment necessitating the need to be reset to grade. From previous experience has indicated relocation of the power pole may involve replacing the timber pole with light weight steel pole at a price of approximately $50,000, therefore for budgetary purposes, $50,000 was used, along with $10,000 per guy-wire pole.

It is however essential to obtain SCE recommendation to confirm the extent of the power pole relocation. It might be also SCE's responsibility to relocate the power pole at their cost, depending upon who may have prior rights.

As mentioned in the previous paragraph, the project is not expected to affect underground utilities; however Attachment C also shows the existing utilities present within the project site.

Structures

The bridge type selection process involves investigating various feasible structure types and the construction costs associated with them. The engineer initially selects, based upon engineering judgment and experience, at least two out of all possible structure types, which are suitable for the proposed project site and conditions. The engineer will investigate in depth the pre-selected structure types for their construction cost, constructibility, aesthetic, environmental issues, etc. After comparing the features of the proposed alternatives, the structure type that is best suited for the project is chosen and presented for concurrence and approval for the final design.

For the project, two alternatives have been considered. Both alternatives have basically the same type of superstructure, with a cast-in-place, prestressed, concrete box girder (CIP/PS Box), and the same type of substructure, with seat type abutments, founded on spread footings. The total length of the bridge is proposed to be 120'-1", measured from the beginning of the bridge point (BB) to the end of the bridge point (EB) on a tangent alignment. Caltrans Type 26 Barrier, with tubular hand railing, is proposed along the east and west edges of the bridge. Bike paths will be constructed under the bridge soffit, next to and, along the south and north abutments. Aesthetic features, including planting materials, view points, and patterns will be included in the design.

The difference between Alternative 1 and Alternative 2 is that Alternative 1 proposes to have the invert of the channel, within the bridge vicinity, lined with soil-cement (hard bottom as described in the hydraulic report), while conversely Alternative 2 proposes to have the invert of the channel unlined (soft bottom as described in the hydraulic report).

The advantage of Alternative 1, with the lined channel invert, is scour problems at the bridge structure are for the most part eliminated. But, the bridge abutment footings will still need to be set deep enough to clear approximately half the scour zone in order to prevent the flood waters from seeping into the soil, thus undermining the load carrying capacity of the soil underneath the footing.

In Alternative 2, with unlined channel invert, scour is a serious concern. Retaining walls will be necessary to line each side of the channel for the bike paths under the bridge. Caltrans Type 1 retaining walls are proposed to be used. These retaining walls, along the channel and the bridge abutment footings, will need to be set deep enough to clear the entire scour zone, which is approximately 10 feet deep from the existing unlined surface of channel invert per the hydraulic report.

At City's request, LAN performed feasibility study of multi-cell reinforced box culvert (RCB). The hydraulic analysis (HEC-RAS Analysis) was modified to represent the culvert concept. For all simulations, this deck elevation was sufficiently high to not affect the hydraulic results—therefore the height of the culverts was not a controlling factor (the heights below were rounded to the nearest foot above the highest upstream water surface elevation). The following are the multi-cell box culvert dimensions (all are clear dimensions) used in the model:

Left bike path culvert:	16 feet wide by 9 feet high
Main channel 1 of 3:	13 feet wide by 9 feet high
Main channel 2 of 3:	14 feet wide by 9 feet high
Main channel 3 of 3:	13 feet wide by 9 feet high
Right bike path culvert:	16 feet wide by 9 feet high

A 1.5 feet thickness was assumed for the vertical culvert walls. Typically, one foot of debris is applied to each side of the pier to account for debris bulking. The freeboard for this scenario was 3.04 feet (min. two (2) feet is required).

The LA County Sedimentation Manual recommends using four (4) feet of debris where heavy floating debris loading is expected. An analysis model with four (4) feet of debris on each pier was also performed. The freeboard for this scenario was 2.27 feet—just above the minimum of two (2) feet. Therefore, this culvert meets both freeboard requirements.

As discussed above, a triple box culvert is required to convey the creek flow through the roadway crossing, while meeting all the freeboard requirements for Capital Flood (50-Year Flood, with double bulking, and this is the control event) and 100-Year Flood (clear flow). In addition, two more cells are required on the outside to accommodate the bike paths.

This RCB structure will require more fill at the approaches and on the box lid unless the profile of the proposed 20th Street West is lowered to the top of the culvert top slab. In addition, the RCB option would necessitate the relocation of several hundred feet of an existing sewer line, currently located along the south bank of the creek.

For the lined channel (Bridge Alternative 1) and the box culvert option, there will be a deep cut-off wall constructed upstream to prevent the scour from undermining the channel lining and the bridge and retaining wall foundations or box culvert.

Structure Type Recommendation:
The approved structure type is a single span, 120'-1" long, and 80'-0" wide, cast-in-place, prestressed (CIP/PS) concrete box girder bridge, supported on two high cantilever seat type abutments. CIP/PS concrete box girder was chosen based upon constructability, performance in a seismic event, construction and long term maintenance costs, and aesthetic reasons. This type of structure is the most common type of bridge used by Caltrans in California, not just because of its comparatively low construction and maintenance costs, but also because of its reliable, superior performance during a seismic event when compared to any other type of structure. Since the project site is located within 1500 to 2000 feet of the San Andreas fault, which is a strike-slip fault capable of generating earthquake with a maximum credible magnitude of 8.0, seismic performance of the bridge is an important consideration. The structure depth will be 5'-6" deep. The high cantilever seat type abutments will be founded on spread footings. Since CIP/PS concrete bridge requires falsework in construction, falsework will have to be constructed on the Amargosa Channel. This will limit the bridge construction window be fixed in the "dry season" between beginning of May to end of October, unless otherwise approved by the DFG.

The recommended structure type is bridge Alternative 1.

For complete information, refer to Attachment G, The Bridge Type Selection Report.

Geotechnical

As mentioned previously, refer to Attachment L, Geotechnical Investigation Report for the geotechnical information at the project site.

Landscaping/ Aesthetics

Landscaping
As mentioned in the above roadway section, there will be a landscape buffer from Elizabeth Lake Road to south of Amargosa Creek along eastside of 20th Street West. It is recommended that trees are to be planted within the buffer in order to provide visual barrier from roadway for the adjacent homes, since the roadway grade is higher than the existing homes. The implementation of this concept will be based upon funding availability.

Aesthetics
This project requires aesthetic study for the bridge design. General aesthetics of the bridge structure is designed by the project architect. Recommendations from the architect will be incorporated into the bridge final design. Aesthetic features, including planting materials, view points, and patterns will be included in the design. Please refer to Attachment H for the current developed concept by project architect.

OTHER CONSIDERED ALTERNATIVES

Alternative 1 was developed to have the proposed roadway alignment curve westerly, cross the Amargosa Creek with an improved skew angle, and curve easterly to join back to its existing alignment before Quick Street. The vertical alignment is developed to allow for the overcrossing structure spanning across, not only the Amargosa Creek, but also the maintenance roads at both side of the channel. The main reason of this alternative being deemed non-viable is because of the proposed roadway would infringe on the future residential development at the northwest quadrant of 20th Street West and Amargosa Creek. The impacting of the future development will defeat the purpose of this project, which proposes implementing roadway improvements consistent with the future residential development around the area. Please refer to Attachment E for exhibit of Alternative 1.

Alternative 2 was developed to have the proposed roadway alignment in place along its existing alignment. Similar to Alternative 1, the vertical alignment was developed to allow both the creek and the maintenance roads. Due to raising the profile of the proposed roadway, and the close proximity of the adjacent housing tract along east side of existing 20th Street West, south of Amargosa Creek; a retaining wall would be needed between the adjacent properties and the proposed roadway, along east side of 20th Street West from Elizabeth Lake Road to Amargosa Creek. This retaining wall is thought to be a non-desirable feature for the local residents, therefore Alternative 2 was deemed non-viable. Please refer to Attachment E for exhibit of Alternative 2.

CONSIDERATIONS REQUIRING DISCUSSION

VALUE ANALYSIS

The estimated project cost, including Right of Way acquisition, is under $25 million. Therefore, no formal Value Analysis (VA) was performed.

RIGHT OF WAY ISSUES

Right of Way Requirements

Refer to Attachment G - Right of Way Acquisition for a detailed analysis of the estimated right of way requirements, which lists the Assessor Parcel Number, the Owner, and the area of required right of way. During the design phase of the project, right of way mapping, per parcel, will need to be accomplished, as well as a legal description for each of the parcels needing acquisition.

Right of way cost is estimated using $7.00/sq. ft for fee take and $3.50/sq. ft for slope easement. The total right of way cost is estimated to be $274,953.

Relocation Impact Studies

There is no relocation anticipated in this project, therefore, the study is not required.

ENVIRONMENTAL ISSUES

Refer to Attachment J – Environmental Report and the approved Environmental Document for a detailed analysis of the environmental impacts and mitigation measures. The following is a list of recommended actions prior to or during construction.

1.12.1 Noise Analysis

Recommended Actions: During all project site excavation and on-site grading, the project contractors should equip all construction equipment, fixed or mobile, with properly operating and maintained mufflers consistent with manufacturers' standards.

The project contractor should place all stationary construction equipment so that emitted noise is directed away from sensitive receptors nearest the project site.

The construction contractor should locate equipment staging in areas that will create the greatest distance between construction-related noise sources and noise-sensitive receptors nearest the project site during all project construction.

During all project site construction, the construction contractor should limit all construction-related activities to the hours of 6:30 a.m. to 8:00 p.m. on weekdays and Saturday and no work on Sunday.

A minimum wall height of 6 feet should be required to reduce traffic noise levels to 65 dBA CNEL or below for all future residential uses along 20th Street West.

The City should coordinate with future residential uses located adjacent to the proposed project to ensure that air-conditioning systems are provided to maintain the City's interior noise standard of 45 dBA CNEL.

1.12.2 Air Quality

Recommended Actions: The Construction Contractor should select the construction equipment used on site based on low-emission factors and high-energy efficiency. The City Engineer should ensure that construction grading plans include a statement that all construction equipment will be tuned and maintained in accordance with the manufacturer's specifications.

The Construction Contractor should utilize electric or diesel-powered equipment in lieu of gasoline-powered engines where feasible as determined by the City Public Works Inspector and Building Inspector.

The Construction Contractor should ensure that construction grading plans reviewed by the City Engineer include a statement that work crews will shut off equipment when not in use and that during smog season (May through October), the overall length of the construction period will be extended, thereby decreasing the size of the area prepared each day to minimize vehicles and equipment operating at the same time.

Under the direction of the City Public Works Inspector, the Construction Contractor should time the construction activities so as to not interfere with peak-hour traffic and minimize obstruction of through traffic lanes adjacent to the site; if necessary, a flagger shall be retained to maintain safety adjacent to existing roadways.

The Construction Contractor should support and encourage ridesharing and transit incentives for the construction crew to the satisfaction of the City Public Works Inspector.

Under review by the City Public Works Inspector, the dust generated by the development activities should be retained on site and kept to a minimum by following the dust control measures listed below.

a. During clearing, grading, earth moving, excavation, or transportation of cut or fill materials, water trucks or sprinkler systems should be used to prevent dust from leaving the site and to create a crust after each day's activities cease.

b. During construction, water trucks or sprinkler systems should be used to keep all areas of vehicle movement damp enough to prevent dust from leaving the site. At a minimum, this would include wetting down such areas in the later morning and after work is completed for the day, and whenever wind exceeds 15 miles per hour.

c. After clearing, grading, earth moving, or excavation is completed, the entire area of disturbed soil should be treated immediately until the area is paved or otherwise developed so that dust generation will not occur.

d. Soil stockpiled for more than two days should be covered, kept moist, or treated with soil binders to prevent dust generation.

e. Trucks transporting soil, sand, cut or fill materials, and/or construction debris to or from the site should be tarped or materials moistened as applicable from the point of origin.

1.12.3 Cultural

Recommended Actions: Prior to the commencement of ground-disturbing activities, the City should retain an archaeologist to monitor the initial ground-disturbing activities. The qualified archaeologist should be on-site during any initial ground-disturbing and earthmoving activities. In the event any archaeological or historical resource is uncovered during the course of the project, ground-disturbing activities in the vicinity of the find should be redirected until the nature and extent of the find can be evaluated by a qualified monitor. Any such resource uncovered during the course of project-related grading or construction should be recorded and/or removed per applicable City and/or State regulations.

A trained paleontological monitor should be present during initial ground-disturbing activities within undisturbed sediments determined likely to contain paleontological resources. The monitoring for paleontological resources should be conducted on a half-time basis when excavation is occurring in undisturbed late Pleistocene Alluvium. If paleontological resources are encountered during excavation, the monitoring should increase to full time. The monitor should be empowered to temporarily halt or redirect construction activities to ensure avoidance of adverse impacts to paleontological resources. The monitor should be equipped to rapidly remove any large fossil specimens encountered during excavation. If small fossil vertebrate remains are located during the monitoring program, standard samples (12 cubic meters/6,000 lbs) of sediment should be collected and processed to recover microvertebrate fossils. Processing should include wet screen washing and microscopic examination of the residual materials to identify small vertebrate remains.

Upon encountering a large deposit of bone, salvage of all bone in the area should be conducted with additional field staff and in accordance with modern paleontological techniques.

All fossils collected during the project should be prepared to a reasonable point of identification. Excess sediment or matrix should be removed from the specimens to reduce the bulk and cost of storage. Itemized catalogs of all material collected and identified should be provided to the museum repository along with the specimens.

A report documenting the results of the monitoring and salvage activities and the significant of the fossils should be prepared.

All fossils collected during this work, along with the itemized inventory of these specimens, should be deposited in a museum repository for permanent curation and storage.

1.12.4 Biological

Recommended Actions: Prior to site grading, a presence/absence focused survey for the short-jointed beavertail cactus (Opuntia basilaris var. brachyclada) should be conducted on the project site by a qualified biologist. If the survey determines the jointed-beavertail cactus to be present, the following avoidance and minimization efforts should be implemented under the direction of the City of Palmdale Planning Department: a) If found during focused survey, relocate members of species to suitable off-site location; b) Install exclusionary fencing along the proposed project limits; c) Limit the construction area to the minimum area necessary; d) Construction access, parking, storage of construction materials, dumping of trash and debris, equipment maintenance, staging, and dispensing of fuel, oil, coolant, or any other toxic substances will occur in designated areas within the construction limits; and e) Contractor pets are prohibited on the construction site.

Prior to site grading, a presence/absence focused survey for the burrowing owl (Athene cunicularia hypugea) should be conducted on the project site by a qualified biologist under the direction of the City of Palmdale Planning Department. If the future survey determines the burrowing owl to be present, protective measures should be required to ensure compliance with the Migratory Bird Treaty Act and other relevant Fish and Game Code requirements. The protective measures determined may include avoidance of an active burrow(s) during nesting season and passive relocation and are to be developed by a certified biologist.

Prior to grading, a presence/absence focused survey for the desert tortoise should be conducted by a certified biologist under the direction of the City of Palmdale Planning Department. The focused survey season for the desert tortoise is March 25 through May 31. If the desert tortoise is found to be present on the project site, consultation with Fish and Wildlife Service (USFWS) and CDFG should occur to determine applicable mitigation measures. Mitigation measures may include the following:

- Relocation of the tortoise under the direction of a certified biologist;
- Fencing of the project site according to standards determined by a certified biologist to preclude future entry of other desert tortoise;
- Mitigation for the loss of desert tortoise habitat at a 3 to 1 ratio at the Desert Tortoise Natural Reserve;
- During grading, the site will be monitored by a certified biologist to verify the absence of the desert tortoise; and
- Periodic visits to the site during the construction phase by a certified biologist to check the construction fencing.

Prior to grading, the City of Palmdale should consult with the CDFG concerning the suitability of the habitat for the Mohave ground squirrel. If the habitat is determined to be suitable and the Mohave ground squirrel(s) are assumed to be present on the project site, mitigation for the loss of Mohave ground squirrel habitat should be negotiated with CDFG. Mitigation may be provided as outlined in the March 29, 2006, correspondence by the City committing to mitigation for impacts to the Amargosa Creek in conjunction with the Operational Law Letter proposed for the project in lieu of the Streambed alteration Agreement.

The construction plans for the project's roadway lighting should include light fixtures that are shielded and directed away from the creek bed as approved by the City of Palmdale Department of Planning.

1.12.5 Relocation Impacts

No relocations are expected with the required right of way.

1.12.6 Visual Impacts

The project should comply with the City's General Plan goals, as applicable:

- Require removal of non-conforming signs per City sign ordinance standards for new uses or substantial revisions to existing uses.
- Encourage undergrounding of all utility facilities for all projects requiring discretionary or ministerial action.
- The preferred alternative designed features to avoid, minimize, or reduce visual impacts to the extent feasible.
- Construction staging areas will be located within City's right of way.
- A Landscape Plan shall be incorporated into the final design, and this is discussed previously within this report, which includes visually pleasing hardscape.

1.12.7 Section 4(f) Impacts

No Section 4(f) impacts are a part of this project.

1.12.8 Title VI Considerations

The Project does not have any Title VI Considerations, since all the sidewalks at intersections shall be constructed with ramps for access to the sidewalk, and these will all comply with ADA requirements.

1.12.9 Geological/Geotechnical

During construction, a licensed geotechnical engineer should be present to observe the soil conditions encountered during excavation of foundations, to verify the applicability of recommendations, and to evaluate the need for design changes if construction methods or subsurface conditions differ from those anticipated.

1.13 OTHER CONSIDERATIONS AS APPROPRIATE

1.13.1 PERMITS

The potential permits necessary to be acquired during the design phase are:

- National Pollutant Discharge Elimination System (NPDES) Permit
- State Water Quality Control Board - 401 Permit
- Permit from Lohontan Regional Water Quality Control Board (RWQCB)
- California Department of Fish and Game – Operational Law Letter **(OBTAINED)**
- US Army Corps of Engineer's (ACOE's) Regulatory Branch – Clean Water Act Section 404

1.13.2 COOPERATIVE AGREEMENTS

There is no cooperative agreement necessary for the Project.

1.13.3 STAGE CONSTRUCTION

The stage construction for this project is considered minor, since there will not be any existing traffic. Therefore, issues of detouring traffic will not be of a significant concern. However, the schedule is an important factor to consider for the construction of the overcrossing structure at Amargosa Creek, due to the rainy season. The beginning of construction within the Amargosa Creek delineated area should be scheduled at the start of dry season to assure the duration of construction will last prior to the next coming rainy season.

1.13.4 FEDERAL INVOLVEMENT

All the cost of this project is locally funded, therefore, there is no federal involvement.

PROGRAMMING

Project Funding Eligibility:

Probable Source of Funds:	City of Palmdale	Private Developers
	Prop. C, Gas Tax, General	City's Requirement

Palmdale will be the lead agency, responsible for securing all funding agreements.

REVIEWS

All the required documents and engineer's concepts has been carefully monitored by the City of Palmdale to assure quality of the product. The City of Palmdale has gone through the process of reviewing the project's preferred alternative exhibit, the project cost estimate, the Geometrical Approval Drawings (GAD), the preliminary drainage study, the environmental reports, the hydraulic report, and the bridge type selection report; and has provided comments to LAN Engineering. LAN Engineering has revised and addressed the City's comments accordingly during the development of this project.

PROJECT PERSONNEL

James Faber ---------- (909) 450-2800
LAN Engineering Corp.
Project Manager

Mohan Char ---------- (949) 450-2800
LAN Engineering Corp.
Senior Structural Engineer

Keen Poong ---------- (949) 450-2800
LAN Engineering Corp.
Project Engineer

Albert Pan ----------(949) 450-2800
LAN Engineering Corp.
Assistant Project Engineer

David Wu ---------- (661) 267-5300
City of Palmdale
Project Manager

Tim Hughes ----------(661) 267-5300
City of Palmdale
Deputy Public Works Director

Bill Padilla ---------- (661) 267-5300
City of Palmdale

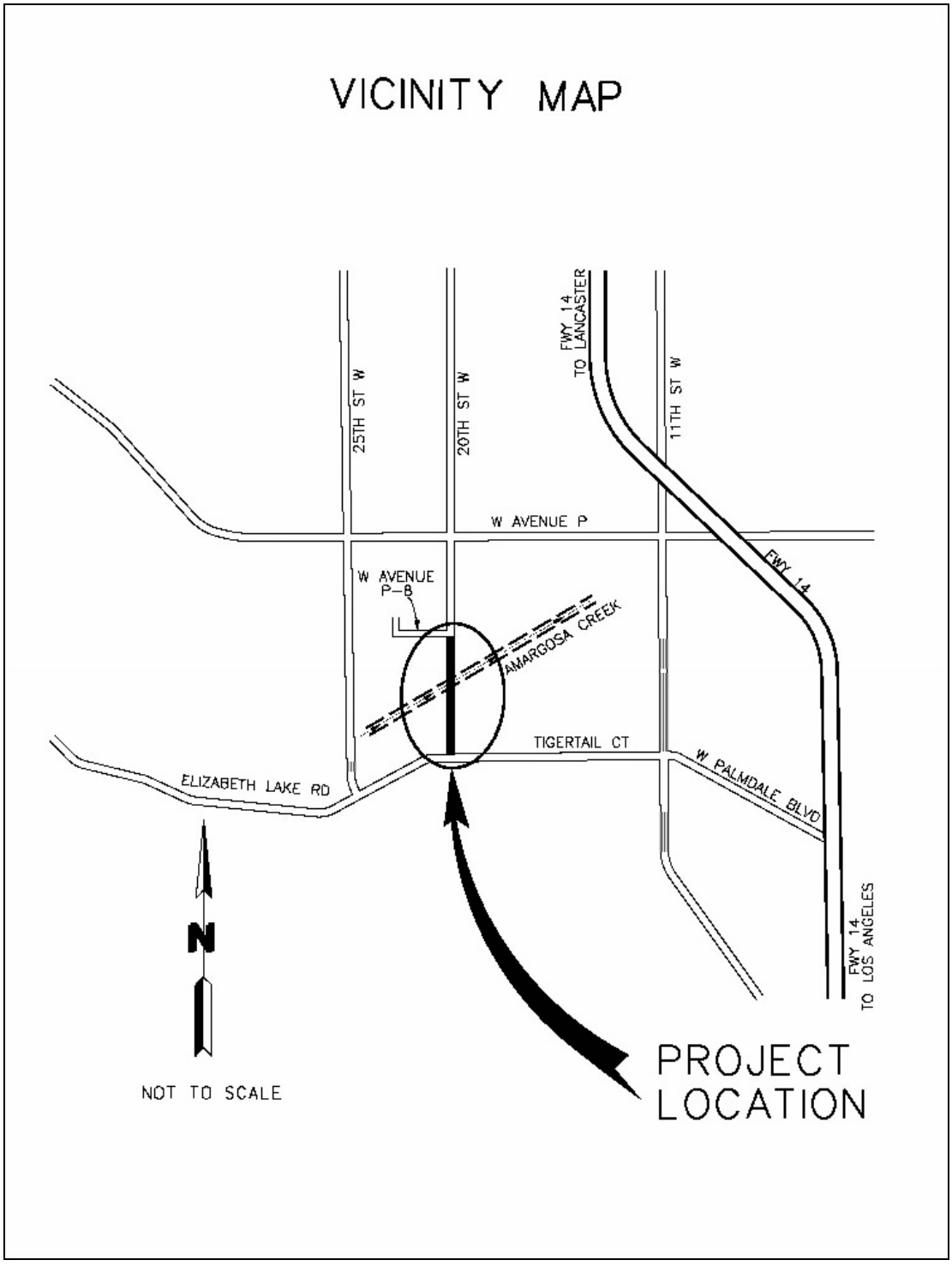
Richard Kite ----------(661) 267-5300
City of Palmdale

Allen Pangan ---------- (661) 267-5300
City of Palmdale

Tom Horne ---------- (661) 267-5300
City of Palmdale

Attachment A
Vicinity Map

Vicinity Map



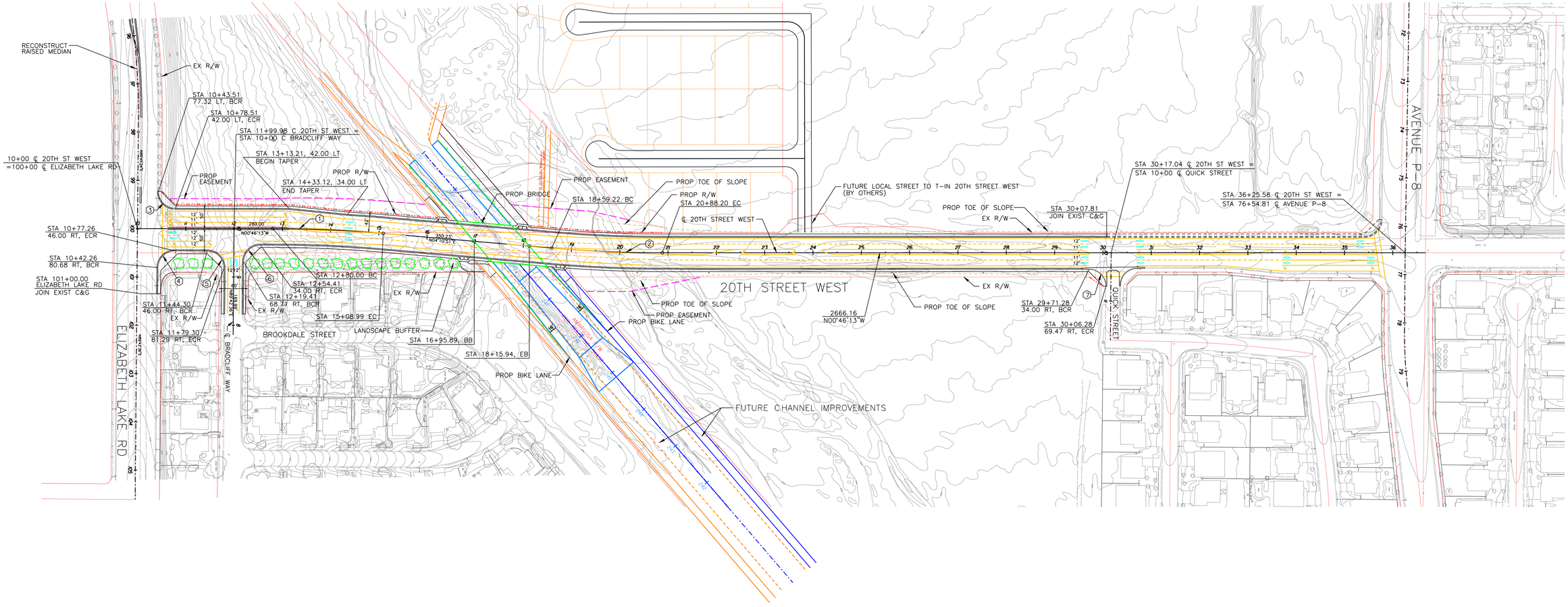
Attachment B

Preferred Alternative Plan, Profiles and Typical Sections

HORIZONTAL DESIGN SPEED = 60 MPH

CURVE DATA

NO	R	Δ	T	L
1	2650.00	4°57'3"	114.56	228.99
2	2650.00	4°57'3"	114.56	228.99
3	35.00	90°31'37"	35.32	55.30
4	35.00	89°28'23"	34.68	54.66
5	35.00	90°28'48"	35.29	55.27
6	35.00	89°31'12"	34.71	54.68
7	35.00	90°46'13"	35.47	55.45

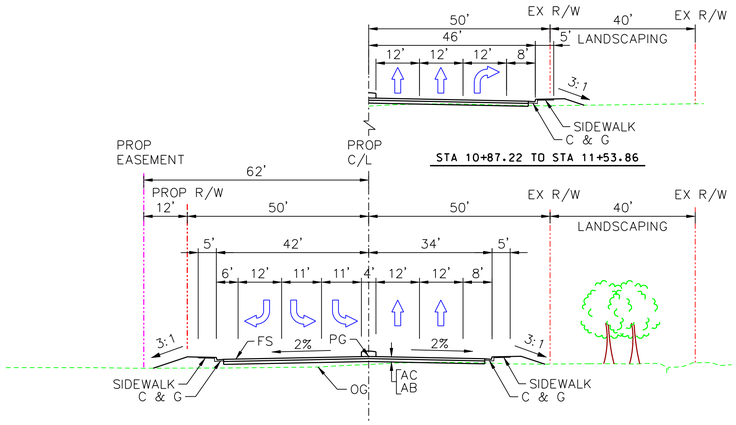


SCALE: 1" = 100'

CITY OF PALMDALE	REVISIONS			PLANS PREPARED BY:		SCALE
CHECKED BY:	NO.	DESCRIPTION	APPR. DATE	LIM & NASCIMENTO ENGINEERING CORP. 12 MAUCHLY, BLDG L IRVINE, CAL 92618 (949) 450-2800	REGISTERED PROFESSIONAL ENGINEER KEEN POONG No. C 66495 Exp. 06/30/06 CIVIL STATE OF CALIFORNIA	AS SHOWN
PLAN CHECK ENGINEER DATE						PROJECT NO.

CITY OF PALMDALE
STREET IMPROVEMENT PLANS
20th STREET WEST BRIDGE
PREFERRED ALTERNATIVE – PLAN

SHT. OF XX



20TH STREET WEST

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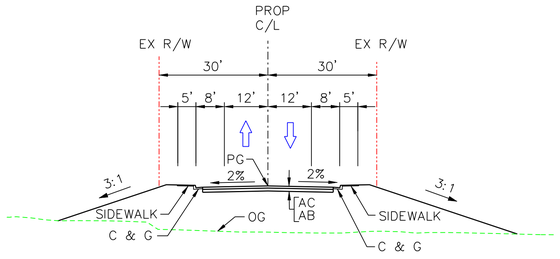
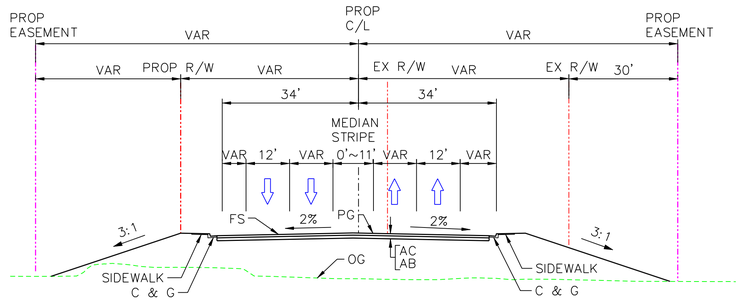


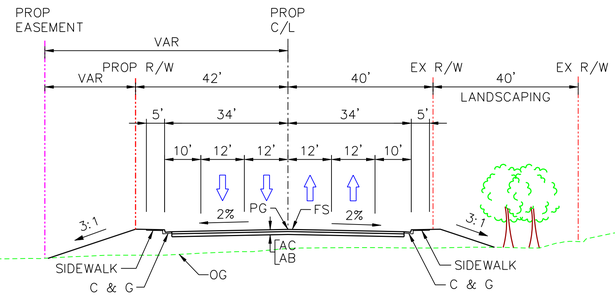
BRADCLIFF WAY

STA 7+80 TO STA 10+00



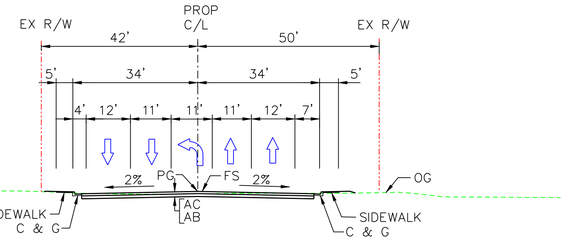
20TH STREET WEST

STA 18+15.94 TO STA 20+93.20



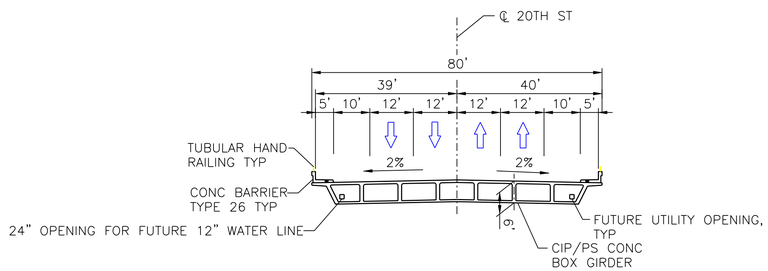
20TH STREET WEST

STA 13+15.01 TO STA 16+95.89



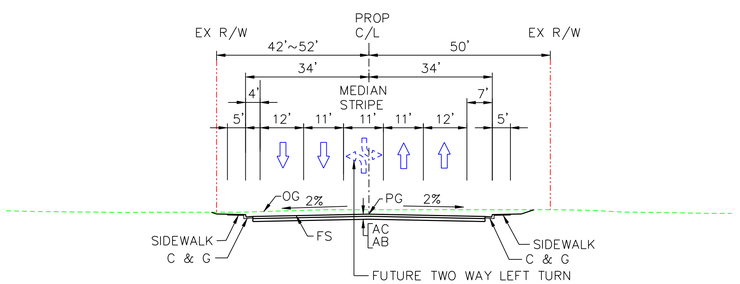
20TH STREET WEST

STA 20+93.20 TO STA 24+00



20TH STREET WEST BRIDGE

STA 16+95.89 TO STA 18+15.94

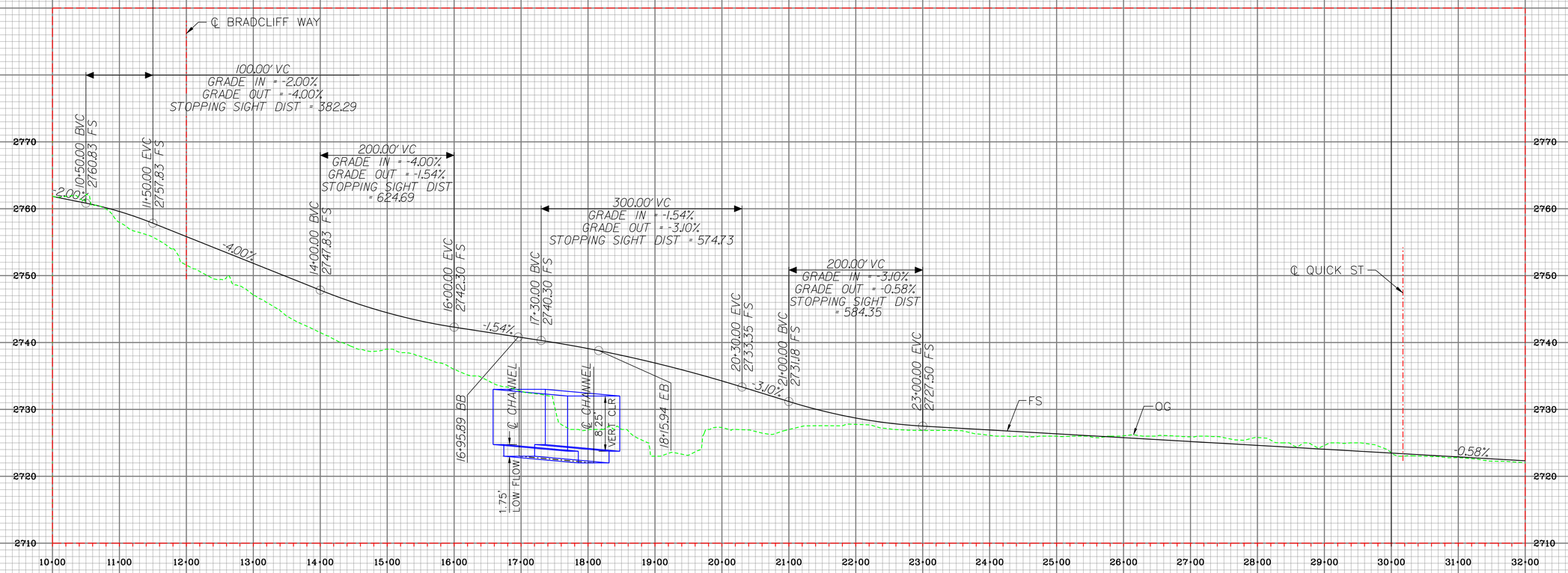


20TH STREET WEST

STA 24+00.50 TO STA 30+00

CITY OF PALMDALE	REVISIONS			PLANS PREPARED BY:	CITY OF PALMDALE	SCALE
CHECKED BY:	NO.	DESCRIPTION	APPR. DATE	LIM & NASCIMENTO ENGINEERING CORP. 12 MAUCHLY, BLDG L IRVINE, CAL 92618 (949) 450-2800	STREET IMPROVEMENT PLANS	AS SHOWN
PLAN CHECK ENGINEER DATE				RECORDED PROFESSIONAL ENGINEER KEZIN POONG No. C 66495 Exp. 06/30/06 CIVIL STATE OF CALIFORNIA	20th STREET WEST BRIDGE	PROJECT NO.
					PREFERRED ALTERNATIVE – TYPICAL SECTIONS	SHT. OF XX

DESIGN SPEED = 60 MPH



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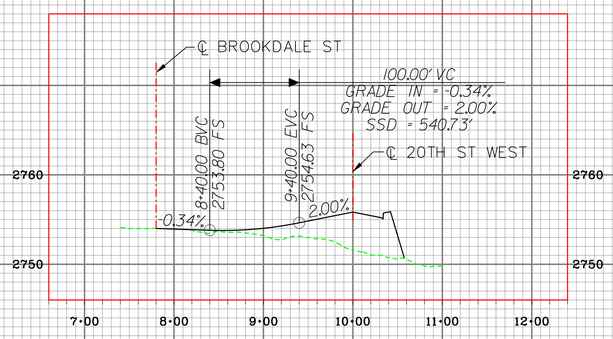


BRADCLIFF WAY

0 40 80 160 240 320 400 480

SCALE: 1" = 80' HOR, 1" = 8' VER

CITY OF PALMDALE

CHECKED BY:

PLAN CHECK ENGINEER DATE

REVISIONS

NO.	DESCRIPTION	APPR.	DATE

PLANS PREPARED BY:
LAN
LIM & NASCIMENTO ENGINEERING CORP.
12 MAUCHLY, BLDG L
IRVINE, CAL 92618
(949) 450-2800

REGISTERED PROFESSIONAL ENGINEER
KEEN POONG
No. C 66495
Exp. 06/30/06
CIVIL
STATE OF CALIFORNIA

CITY OF PALMDALE

STREET IMPROVEMENT PLANS

20th STREET WEST BRIDGE

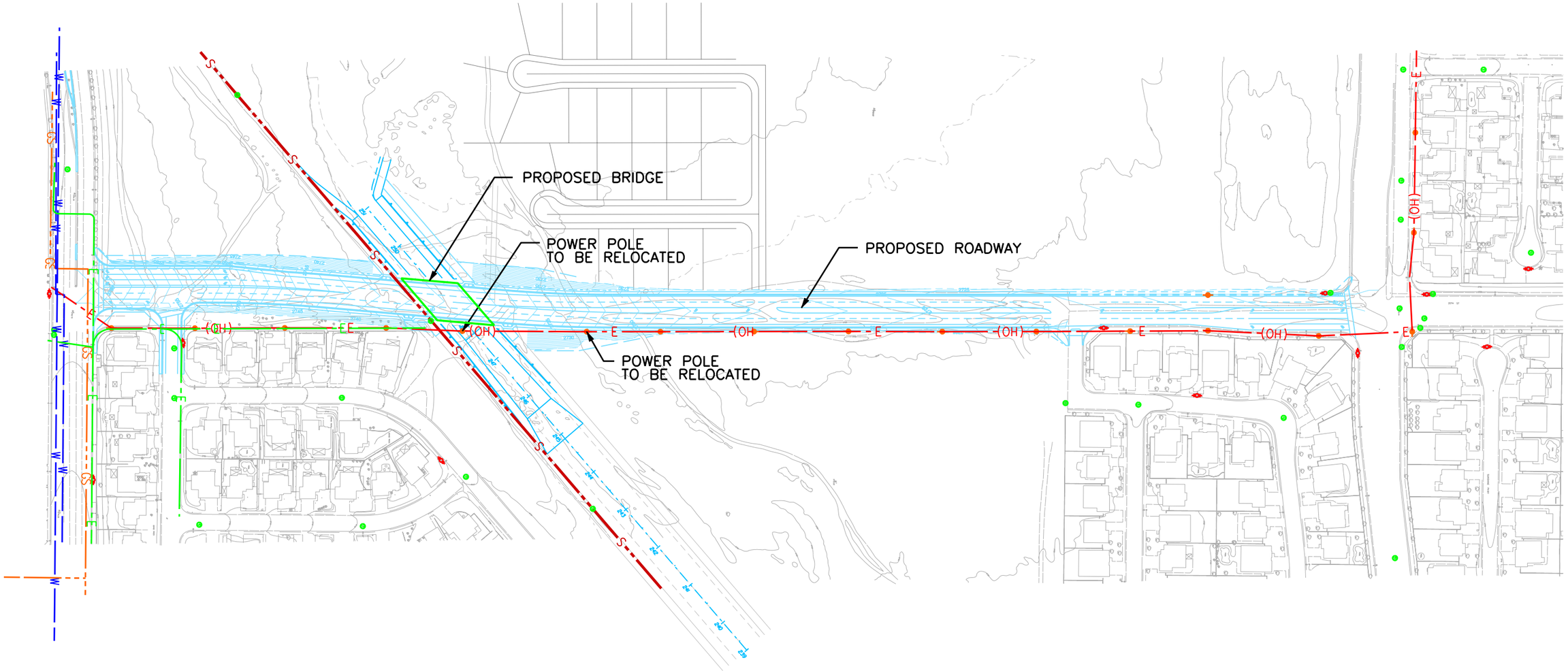
PREFERRED ALTERNATIVE – PROFILE

SCALE AS SHOWN

PROJECT NO.

SHT. OF XX

Attachment C
Utility Map



LEGEND

WATER LINE	W	MANHOLE	
SEWER LINE	S	FIRE HYDRANT	
GAS LINE	GS	POWER POLE	
OVERHEAD ELECTRICITY	E (OH)		
UNDERGROUND ELECTRICITY	E		

ATTACHMENT C

CITY OF PALMDALE
CHECKED BY:
PLAN CHECK ENGINEER DATE

REVISIONS

NO.	DESCRIPTION	APPR.	DATE

PLANS PREPARED BY:
LIM & NASCIMENTO ENGINEERING CORP.
12 MAUCHLY, BLDG L
IRVINE, CAL 92618
(949) 450-2800

REGISTERED PROFESSIONAL ENGINEER — KEEN POONG — No. C 66495 Exp. 06/30/06 — CIVIL — STATE OF CALIFORNIA

CITY OF PALMDALE
20th STREET WEST BRIDGE
UTILITY MAP

SCALE AS SHOWN
PROJECT NO.
SHT. OF XX

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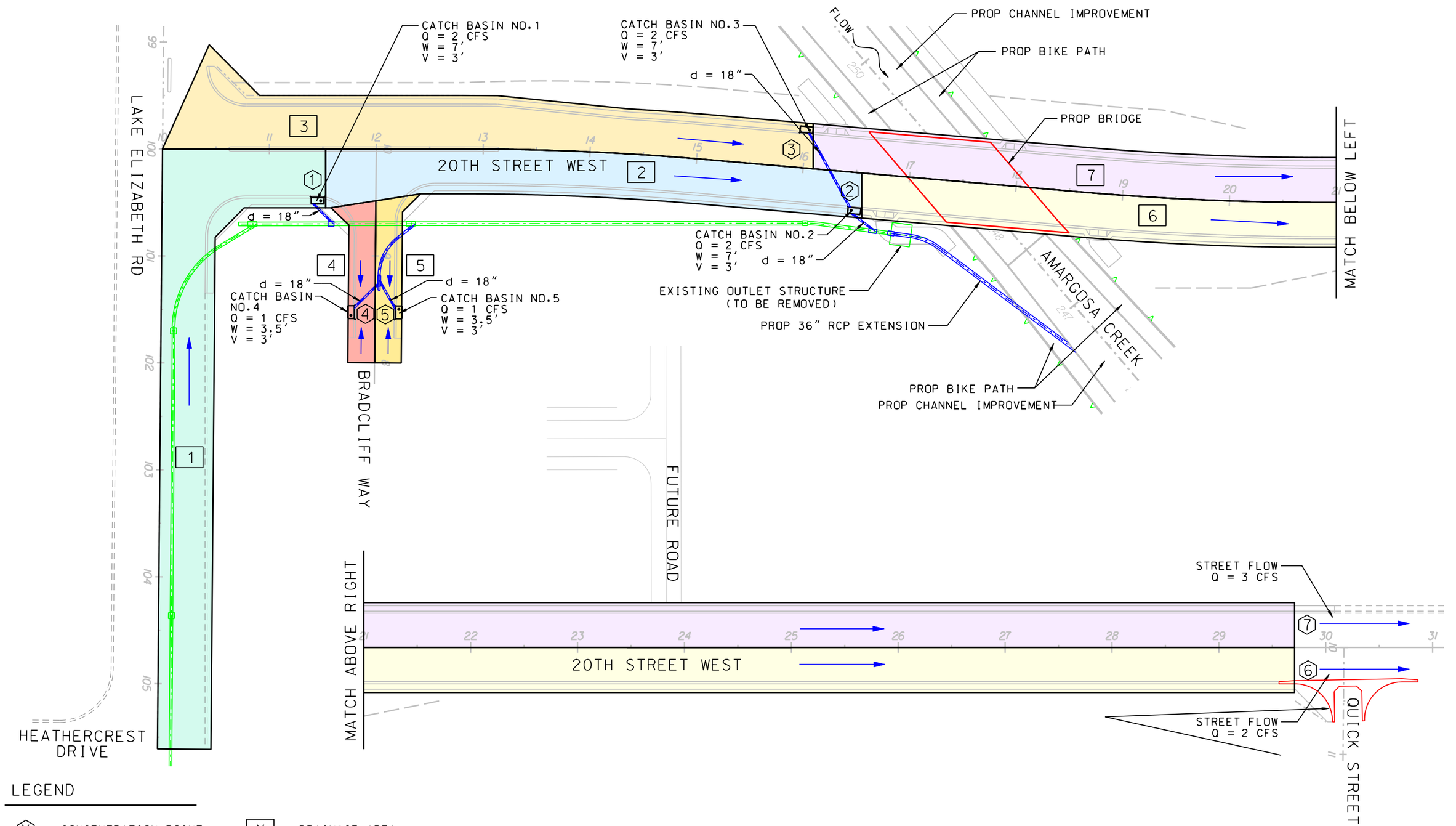
Attachment D
Drainage Improvements



LEGEND

- CONCENTRATION POINT
- X DRAINAGE AREA
- SUBDRAINAGE BOUNDARY
- STREET FLOW DIRECTION
- PROPOSED CATCH BASIN
- PROPOSED 36" STORM DRAIN PIPE (BY OTHERS)
- PROPOSED STORM DRAIN

ONSITE DRAINAGE PLAN

NO SCALE

ABBREVIATION

Q: FLOW RATE
W: CATCH BASIN LENGTH
V: CATCH BASIN DEPTH
d: CONNECTOR PIPE DIAMETER

ATTACHMENT D

LIM & NASCIMENTO
ENGINEERING CORP.

City of Palmdale
20th Street West

Summary of Sizes of Catch Basins and Connector Pipe

Catch Basin Number	Design Storm	Concentration Point	Slope (S)	Flow Per Catch Basin (Q) (cfs)	Q/S^0.5	Water Depth (H) (ft)	Water Spread (W) (ft)	Type of Catch Basin	Designed Catch Basin Length (ft)	Flow Intercepted (cfs)	Flow-by (cfs)	Catch basin Depth (V) (ft)	Connector Pipe Diameter (d) (ft)
1	10yr	1	2.85%	2.00	11.85	0.27	7.27	Curb Opening	7.00	2.00	0.00	3.00	1.50
2	10yr	2	3.10%	2.00	11.36	0.27	7.27	Curb Opening	7.00	2.00	0.00	3.00	1.50
3	10yr	3	3.30%	2.00	11.01	0.27	7.27	Curb Opening	7.00	2.00	0.00	3.00	1.50
4	10yr	4		1.00				Curb Opening in Sump	3.50	1.00	0.00	3.00	1.50
5	10yr	5		1.00				Curb Opening in Sump	3.50	1.00	0.00	3.00	1.50

STREET CAPACITY TABLE

LOCATION: CB #1
CURB HEIGHT: 8"
SLOPE: 2.85%

	FLOODED				CONVEYANCE FACTORS		
DEPTH (H)	**FLOW AREA**	**SPREAD (W)**	**V**	**Q**	**V/S^.5**	**Q/S^.5**	**V x H**
FT	SQFT	FT	FT/S	FT^3/S			
0.01	0.00	0.12	0.43	0.00	2.54	0.00	0.00
0.02	0.00	0.25	0.68	0.00	4.03	0.01	0.01
0.03	0.01	0.37	0.89	0.01	5.28	0.03	0.03
0.04	0.01	0.49	1.08	0.01	6.39	0.07	0.04
0.05	0.02	0.62	1.25	0.02	7.42	0.11	0.06
0.06	0.02	0.74	1.41	0.03	8.38	0.18	0.08
0.07	0.03	0.86	1.57	0.05	9.28	0.28	0.11
0.08	0.04	0.98	1.71	0.07	10.15	0.40	0.14
0.09	0.05	1.11	1.85	0.09	10.98	0.54	0.17
0.10	0.06	1.23	1.99	0.12	11.78	0.72	0.20
0.11	0.07	1.35	2.12	0.16	12.55	0.94	0.23
0.12	0.09	1.48	2.25	0.20	13.30	1.18	0.27
0.13	0.10	1.60	2.37	0.25	14.03	1.46	0.31
0.14	0.12	1.72	2.49	0.30	14.74	1.78	0.35
0.15	0.14	1.85	2.61	0.36	15.43	2.13	0.39
0.16	0.16	1.97	2.72	0.43	16.11	2.54	0.44
0.17	0.18	2.24	2.73	0.49	16.16	2.88	0.46
0.18	0.20	2.75	2.64	0.54	15.65	3.17	0.48
0.19	0.23	3.25	2.62	0.61	15.51	3.61	0.50
0.20	0.27	3.75	2.63	0.71	15.59	4.18	0.53
0.21	0.31	4.25	2.67	0.82	15.83	4.88	0.56
0.22	0.35	4.76	2.73	0.96	16.18	5.71	0.60
0.23	0.40	5.26	2.80	1.13	16.59	6.69	0.64
0.24	0.46	5.76	2.88	1.32	17.07	7.82	0.69
0.25	0.52	6.26	2.97	1.54	17.57	9.10	0.74
0.26	0.58	6.77	3.06	1.78	18.11	10.56	0.79
0.27	0.65	7.27	3.15	2.06	18.66	12.19	0.85
0.28	0.73	7.77	3.25	2.37	19.22	14.01	0.91
0.29	0.81	8.27	3.34	2.70	19.80	16.02	0.97
0.30	0.89	8.78	3.44	3.08	20.38	18.22	1.03
0.31	0.98	9.28	3.54	3.48	20.96	20.64	1.10
0.32	1.08	9.78	3.64	3.93	21.55	23.27	1.16
0.33	1.18	10.28	3.74	4.41	22.14	26.12	1.23

STREET CAPACITY TABLE

LOCATION: CB #1
CURB HEIGHT: 8"
SLOPE: 2.85%

	FLOODED				CONVEYANCE FACTORS		
DEPTH (H)	**FLOW AREA**	**SPREAD (W)**	**V**	**Q**	**V/S^.5**	**Q/S^.5**	**V x H**
FT	SQFT	FT	FT/S	FT^3/S			
0.34	1.29	10.79	3.84	4.93	22.72	29.21	1.30
0.35	1.40	11.29	3.94	5.49	23.31	32.53	1.38
0.36	1.51	11.79	4.03	6.10	23.89	36.10	1.45
0.37	1.63	12.29	4.13	6.74	24.47	39.92	1.53
0.38	1.76	12.80	4.23	7.43	25.05	44.01	1.61
0.39	1.89	13.30	4.33	8.17	25.63	48.37	1.69
0.40	2.02	13.80	4.42	8.95	26.19	52.99	1.77
0.41	2.16	14.30	4.52	9.78	26.76	57.90	1.85
0.42	2.31	14.81	4.61	10.65	27.33	63.10	1.94
0.43	2.46	15.31	4.71	11.58	27.89	68.60	2.02
0.44	2.62	15.81	4.80	12.56	28.45	74.40	2.11
0.45	2.78	16.31	4.90	13.59	29.00	80.51	2.20
0.46	2.94	16.82	4.99	14.68	29.55	86.93	2.29
0.47	3.11	17.32	5.08	15.81	30.10	93.67	2.39
0.48	3.29	17.82	5.17	17.01	30.64	100.75	2.48
0.49	3.47	18.32	5.26	18.26	31.18	108.16	2.58
0.50	3.65	18.83	5.36	19.57	31.72	115.91	2.68
0.51	3.85	19.33	5.45	20.94	32.25	124.01	2.78
0.52	4.04	19.83	5.53	22.36	32.78	132.46	2.88
0.53	4.24	20.33	5.62	23.85	33.31	141.28	2.98
0.54	4.45	20.84	5.71	25.40	33.83	150.46	3.08
0.55	4.66	21.34	5.80	27.01	34.35	160.01	3.19
0.56	4.87	21.84	5.89	28.69	34.87	169.94	3.30
0.57	5.10	22.34	5.97	30.43	35.38	180.25	3.40
0.58	5.32	22.85	6.06	32.24	35.89	190.96	3.51
0.59	5.55	23.35	6.14	34.11	36.39	202.06	3.62
0.60	5.79	23.85	6.23	36.05	36.90	213.57	3.74
0.61	6.03	24.35	6.31	38.07	37.40	225.48	3.85
0.62	6.28	24.86	6.40	40.15	37.90	237.80	3.97
0.63	6.53	25.36	6.48	42.30	38.39	250.55	4.08
0.64	6.78	25.86	6.56	44.52	38.88	263.72	4.20
0.65	7.04	26.36	6.65	46.82	39.37	277.33	4.32
0.66	7.31	26.87	6.73	49.19	39.86	291.36	4.44

STREET CAPACITY TABLE

LOCATION: CB #1
CURB HEIGHT: 8"
SLOPE: 2.85%

	FLOODED				CONVEYANCE FACTORS		
DEPTH (H)	**FLOW AREA**	**SPREAD (W)**	**V**	**Q**	**V/S^.5**	**Q/S^.5**	**V x H**
FT	SQFT	FT	FT/S	FT^3/S			
0.67	7.58	27.51	6.75	51.16	39.98	303.05	4.52
0.68	7.86	28.50	6.64	52.16	39.30	308.94	4.51
0.69	8.15	29.49	6.54	53.29	38.73	315.68	4.51
0.70	8.45	30.48	6.46	54.56	38.25	323.20	4.52
0.71	8.76	31.47	6.39	55.96	37.84	331.47	4.54
0.72	9.08	32.46	6.33	57.47	37.49	340.44	4.56
0.73	9.41	33.45	6.28	59.10	37.21	350.08	4.59
0.74	9.75	34.44	6.24	60.84	36.97	360.39	4.62
0.75	10.10	35.43	6.21	62.69	36.77	371.34	4.66
0.76	10.46	36.42	6.18	64.64	36.61	382.91	4.70
0.77	10.83	37.21	6.18	66.88	36.59	396.15	4.76
0.78	11.20	37.70	6.20	69.45	36.73	411.36	4.84
0.79	11.58	38.20	6.22	72.07	36.86	426.88	4.92
0.80	11.97	38.69	6.25	74.74	37.00	442.73	5.00
0.81	12.35	39.18	6.27	77.47	37.15	458.89	5.08
0.82	12.75	39.67	6.30	80.25	37.29	475.37	5.16
0.83	13.15	40.02	6.35	83.49	37.61	494.56	5.27
0.84	13.55	40.02	6.48	87.75	38.37	519.76	5.44
0.85	13.95	40.02	6.60	92.08	39.11	545.44	5.61
0.86	14.35	40.02	6.73	96.50	39.84	571.61	5.78
0.87	14.75	40.03	6.85	101.00	40.56	598.26	5.96
0.88	15.15	40.03	6.97	105.58	41.28	625.38	6.13
0.89	15.55	40.03	7.09	110.24	42.00	652.98	6.31
0.90	15.95	40.03	7.21	114.97	42.70	681.05	6.49

STREET CAPACITY TABLE

LOCATION: CB #2
CURB HEIGHT: 8"
SLOPE: 3.10%

	FLOODED				CONVEYANCE FACTORS		
DEPTH (H)	**FLOW AREA**	**SPREAD (W)**	**V**	**Q**	**V/S^.5**	**Q/S^.5**	**V x H**
FT	SQFT	FT	FT/S	FT^3/S			
0.01	0.00	0.12	0.45	0.00	2.54	0.00	0.00
0.02	0.00	0.25	0.71	0.00	4.03	0.01	0.01
0.03	0.01	0.37	0.93	0.01	5.28	0.03	0.03
0.04	0.01	0.49	1.13	0.01	6.39	0.06	0.05
0.05	0.02	0.62	1.31	0.02	7.42	0.11	0.07
0.06	0.02	0.74	1.48	0.03	8.38	0.19	0.09
0.07	0.03	0.86	1.63	0.05	9.28	0.28	0.11
0.08	0.04	0.98	1.79	0.07	10.15	0.40	0.14
0.09	0.05	1.11	1.93	0.10	10.98	0.55	0.17
0.10	0.06	1.23	2.07	0.13	11.77	0.72	0.21
0.11	0.07	1.35	2.21	0.16	12.55	0.93	0.24
0.12	0.09	1.48	2.34	0.21	13.30	1.18	0.28
0.13	0.10	1.60	2.47	0.26	14.02	1.46	0.32
0.14	0.12	1.72	2.60	0.31	14.74	1.78	0.36
0.15	0.14	1.85	2.72	0.38	15.43	2.14	0.41
0.16	0.16	1.97	2.84	0.45	16.11	2.53	0.45
0.17	0.18	2.24	2.85	0.51	16.16	2.87	0.48
0.18	0.20	2.75	2.76	0.56	15.65	3.17	0.50
0.19	0.23	3.25	2.73	0.64	15.51	3.61	0.52
0.20	0.27	3.75	2.75	0.74	15.59	4.17	0.55
0.21	0.31	4.25	2.79	0.86	15.83	4.87	0.59
0.22	0.35	4.76	2.85	1.01	16.18	5.71	0.63
0.23	0.40	5.26	2.92	1.18	16.60	6.69	0.67
0.24	0.46	5.76	3.01	1.38	17.07	7.82	0.72
0.25	0.52	6.26	3.09	1.60	17.57	9.10	0.77
0.26	0.58	6.77	3.19	1.86	18.11	10.56	0.83
0.27	0.65	7.27	3.29	2.15	18.66	12.19	0.89
0.28	0.73	7.77	3.39	2.47	19.23	14.01	0.95
0.29	0.81	8.27	3.49	2.82	19.80	16.02	1.01
0.30	0.89	8.78	3.59	3.21	20.38	18.22	1.08
0.31	0.98	9.28	3.69	3.63	20.96	20.64	1.14
0.32	1.08	9.78	3.79	4.10	21.55	23.27	1.21

STREET CAPACITY TABLE

LOCATION: CB #2
CURB HEIGHT: 8"
SLOPE: 3.10%

	FLOODED				CONVEYANCE FACTORS		
DEPTH (H)	**FLOW AREA**	**SPREAD (W)**	**V**	**Q**	**V/S^.5**	**Q/S^.5**	**V x H**
FT	SQFT	FT	FT/S	FT^3/S			
0.33	1.18	10.28	3.90	4.60	22.14	26.12	1.29
0.34	1.29	10.79	4.00	5.14	22.72	29.21	1.36
0.35	1.40	11.29	4.10	5.73	23.31	32.53	1.44
0.36	1.51	11.79	4.21	6.36	23.89	36.11	1.51
0.37	1.63	12.29	4.31	7.03	24.47	39.93	1.59
0.38	1.76	12.80	4.41	7.75	25.05	44.01	1.68
0.39	1.89	13.30	4.51	8.52	25.63	48.37	1.76
0.40	2.02	13.80	4.61	9.33	26.19	52.99	1.84
0.41	2.16	14.30	4.71	10.20	26.76	57.90	1.93
0.42	2.31	14.81	4.81	11.11	27.33	63.11	2.02
0.43	2.46	15.31	4.91	12.08	27.89	68.60	2.11
0.44	2.62	15.81	5.01	13.10	28.45	74.40	2.20
0.45	2.78	16.31	5.11	14.17	29.00	80.50	2.30
0.46	2.94	16.82	5.20	15.31	29.55	86.93	2.39
0.47	3.11	17.32	5.30	16.49	30.10	93.67	2.49
0.48	3.29	17.82	5.40	17.74	30.64	100.75	2.59
0.49	3.47	18.32	5.49	19.04	31.18	108.16	2.69
0.50	3.65	18.83	5.59	20.41	31.72	115.91	2.79
0.51	3.85	19.33	5.68	21.83	32.25	124.01	2.90
0.52	4.04	19.83	5.77	23.32	32.78	132.46	3.00
0.53	4.24	20.33	5.86	24.87	33.31	141.27	3.11
0.54	4.45	20.84	5.96	26.49	33.83	150.45	3.22
0.55	4.66	21.34	6.05	28.17	34.35	160.01	3.33
0.56	4.87	21.84	6.14	29.92	34.87	169.94	3.44
0.57	5.10	22.34	6.23	31.74	35.38	180.25	3.55
0.58	5.32	22.85	6.32	33.62	35.89	190.96	3.67
0.59	5.55	23.35	6.41	35.58	36.39	202.06	3.78
0.60	5.79	23.85	6.50	37.60	36.90	213.57	3.90
0.61	6.03	24.35	6.59	39.70	37.40	225.48	4.02
0.62	6.28	24.86	6.67	41.87	37.89	237.81	4.14
0.63	6.53	25.36	6.76	44.11	38.39	250.55	4.26
0.64	6.78	25.86	6.85	46.43	38.88	263.72	4.38

STREET CAPACITY TABLE

LOCATION: CB #2
CURB HEIGHT: 8"
SLOPE: 3.10%

	FLOODED				CONVEYANCE FACTORS		
DEPTH (H)	**FLOW AREA**	**SPREAD (W)**	**V**	**Q**	**V/S^.5**	**Q/S^.5**	**V x H**
FT	SQFT	FT	FT/S	FT^3/S			
0.65	7.04	26.36	6.93	48.83	39.38	277.32	4.51
0.66	7.31	26.87	7.02	51.30	39.86	291.36	4.63
0.67	7.58	27.51	7.04	53.36	39.98	303.06	4.72
0.68	7.86	28.50	6.92	54.41	39.31	309.02	4.71
0.69	8.15	29.49	6.82	55.61	38.75	315.82	4.71
0.70	8.45	30.47	6.74	56.94	38.27	323.39	4.72
0.71	8.76	31.46	6.67	58.40	37.87	331.70	4.73
0.72	9.08	32.44	6.61	59.99	37.53	340.71	4.76
0.73	9.41	33.43	6.56	61.69	37.24	350.40	4.79
0.74	9.75	34.42	6.52	63.52	37.00	360.74	4.82
0.75	10.10	35.40	6.48	65.45	36.82	371.72	4.86
0.76	10.46	36.39	6.46	67.49	36.66	383.32	4.91
0.77	10.83	37.37	6.43	69.64	36.54	395.55	4.95
0.78	11.20	38.36	6.42	71.90	36.45	408.38	5.01
0.79	11.59	39.20	6.44	74.66	36.58	424.02	5.09
0.80	11.99	39.70	6.54	78.42	37.16	445.40	5.23
0.81	12.39	40.00	6.66	82.49	37.83	468.48	5.39

STREET CAPACITY TABLE

LOCATION: CB #3
CURB HEIGHT: 8"
SLOPE: 3.50%

	FLOODED				CONVEYANCE FACTORS		
DEPTH (H)	**FLOW AREA**	**SPREAD (W)**	**V**	**Q**	**V/S^.5**	**Q/S^.5**	**V x H**
FT	SQFT	FT	FT/S	FT^3/S			
0.01	0.00	0.12	0.48	0.00	2.54	0.00	0.00
0.02	0.00	0.25	0.75	0.00	4.02	0.01	0.02
0.03	0.01	0.37	0.99	0.01	5.28	0.03	0.03
0.04	0.01	0.49	1.20	0.01	6.39	0.06	0.05
0.05	0.02	0.62	1.39	0.02	7.42	0.11	0.07
0.06	0.02	0.74	1.57	0.04	8.38	0.19	0.09
0.07	0.03	0.86	1.74	0.05	9.28	0.28	0.12
0.08	0.04	0.98	1.90	0.08	10.15	0.40	0.15
0.09	0.05	1.11	2.05	0.10	10.97	0.55	0.18
0.10	0.06	1.23	2.20	0.14	11.78	0.72	0.22
0.11	0.07	1.35	2.35	0.18	12.55	0.94	0.26
0.12	0.09	1.48	2.49	0.22	13.30	1.18	0.30
0.13	0.10	1.60	2.62	0.27	14.03	1.46	0.34
0.14	0.12	1.72	2.76	0.33	14.74	1.77	0.39
0.15	0.14	1.85	2.89	0.40	15.43	2.13	0.43
0.16	0.16	1.97	3.01	0.47	16.11	2.53	0.48
0.17	0.18	2.24	3.02	0.54	16.16	2.88	0.51
0.18	0.20	2.75	2.93	0.59	15.65	3.18	0.53
0.19	0.23	3.25	2.90	0.68	15.51	3.61	0.55
0.20	0.27	3.75	2.92	0.78	15.59	4.17	0.58
0.21	0.31	4.25	2.96	0.91	15.83	4.87	0.62
0.22	0.35	4.76	3.03	1.07	16.17	5.71	0.67
0.23	0.40	5.26	3.11	1.25	16.60	6.69	0.71
0.24	0.46	5.76	3.19	1.46	17.06	7.82	0.77
0.25	0.52	6.26	3.29	1.70	17.57	9.11	0.82
0.26	0.58	6.77	3.39	1.98	18.10	10.56	0.88
0.27	0.65	7.27	3.49	2.28	18.66	12.19	0.94
0.28	0.73	7.77	3.60	2.62	19.22	14.01	1.01
0.29	0.81	8.27	3.70	3.00	19.80	16.01	1.07
0.30	0.89	8.78	3.81	3.41	20.38	18.22	1.14
0.31	0.98	9.28	3.92	3.86	20.96	20.64	1.22
0.32	1.08	9.78	4.03	4.35	21.55	23.27	1.29

STREET CAPACITY TABLE

LOCATION: CB #3
CURB HEIGHT: 8"
SLOPE: 3.50%

	FLOODED				CONVEYANCE FACTORS		
DEPTH (H)	**FLOW AREA**	**SPREAD (W)**	**V**	**Q**	**V/S^.5**	**Q/S^.5**	**V x H**
FT	SQFT	FT	FT/S	FT^3/S			
0.33	1.18	10.28	4.14	4.89	22.13	26.12	1.37
0.34	1.29	10.79	4.25	5.46	22.72	29.21	1.45
0.35	1.40	11.29	4.36	6.09	23.31	32.53	1.53
0.36	1.51	11.79	4.47	6.75	23.89	36.10	1.61
0.37	1.63	12.29	4.58	7.47	24.47	39.93	1.69
0.38	1.76	12.80	4.69	8.23	25.05	44.01	1.78
0.39	1.89	13.30	4.79	9.05	25.63	48.36	1.87
0.40	2.02	13.80	4.90	9.91	26.20	52.99	1.96
0.41	2.16	14.30	5.01	10.83	26.76	57.90	2.05
0.42	2.31	14.81	5.11	11.81	27.33	63.11	2.15
0.43	2.46	15.31	5.22	12.83	27.89	68.60	2.24
0.44	2.62	15.81	5.32	13.92	28.45	74.39	2.34
0.45	2.78	16.31	5.43	15.06	29.00	80.50	2.44
0.46	2.94	16.82	5.53	16.26	29.55	86.93	2.54
0.47	3.11	17.32	5.63	17.53	30.10	93.68	2.65
0.48	3.29	17.82	5.73	18.85	30.64	100.75	2.75
0.49	3.47	18.32	5.83	20.23	31.18	108.16	2.86
0.50	3.65	18.83	5.93	21.68	31.72	115.91	2.97
0.51	3.85	19.33	6.03	23.20	32.25	124.01	3.08
0.52	4.04	19.83	6.13	24.78	32.78	132.46	3.19
0.53	4.24	20.33	6.23	26.43	33.31	141.27	3.30
0.54	4.45	20.84	6.33	28.15	33.83	150.45	3.42
0.55	4.66	21.34	6.43	29.94	34.35	160.01	3.53
0.56	4.87	21.84	6.52	31.79	34.87	169.94	3.65
0.57	5.10	22.34	6.62	33.72	35.38	180.25	3.77
0.58	5.32	22.85	6.71	35.73	35.89	190.96	3.89
0.59	5.55	23.35	6.81	37.80	36.40	202.06	4.02
0.60	5.79	23.85	6.90	39.96	36.90	213.57	4.14
0.61	6.03	24.35	7.00	42.18	37.40	225.48	4.27
0.62	6.28	24.86	7.09	44.49	37.90	237.80	4.40
0.63	6.53	25.36	7.18	46.87	38.39	250.55	4.53
0.64	6.78	25.86	7.28	49.34	38.89	263.72	4.66

STREET CAPACITY TABLE

LOCATION: CB #3
CURB HEIGHT: 8"
SLOPE: 3.50%

	FLOODED				CONVEYANCE FACTORS		
DEPTH (H)	FLOW AREA	SPREAD (W)	V	Q	V/S^.5	Q/S^.5	V x H
FT	SQFT	FT	FT/S	FT^3/S			
0.65	7.04	26.36	7.37	51.88	39.37	277.33	4.79
0.66	7.31	26.87	7.46	54.51	39.86	291.36	4.92
0.67	7.58	27.51	7.48	56.70	39.98	303.05	5.01
0.68	7.86	28.50	7.35	57.80	39.30	308.94	5.00
0.69	8.15	29.49	7.25	59.06	38.73	315.68	5.00
0.70	8.45	30.48	7.16	60.47	38.25	323.20	5.01
0.71	8.76	31.47	7.08	62.01	37.84	331.47	5.03
0.72	9.08	32.46	7.01	63.69	37.49	340.44	5.05
0.73	9.41	33.45	6.96	65.50	37.20	350.09	5.08
0.74	9.75	34.44	6.92	67.42	36.97	360.39	5.12
0.75	10.10	35.43	6.88	69.47	36.77	371.34	5.16
0.76	10.46	36.42	6.85	71.64	36.61	382.92	5.21
0.77	10.83	37.41	6.83	73.92	36.49	395.11	5.26
0.78	11.21	38.40	6.81	76.31	36.40	407.91	5.31
0.79	11.60	39.39	6.80	78.82	36.34	421.32	5.37
0.80	11.99	40.38	6.79	81.44	36.29	435.33	5.43
0.81	12.40	41.17	6.80	84.37	36.36	450.96	5.51
0.82	12.82	41.66	6.84	87.66	36.56	468.54	5.61
0.83	13.24	42.00	6.91	91.43	36.92	488.72	5.73

CATCH BASIN NO. 4 & 5 CALCULATION

SUMP FORMULA:
$Q = 4.3AD^{0.6}$

Q: FLOW INTERCEPTED
A: CURB OPENING AREA
D: FLOW DEPTH AT GUTTER

CURB HEIGHT = 8"

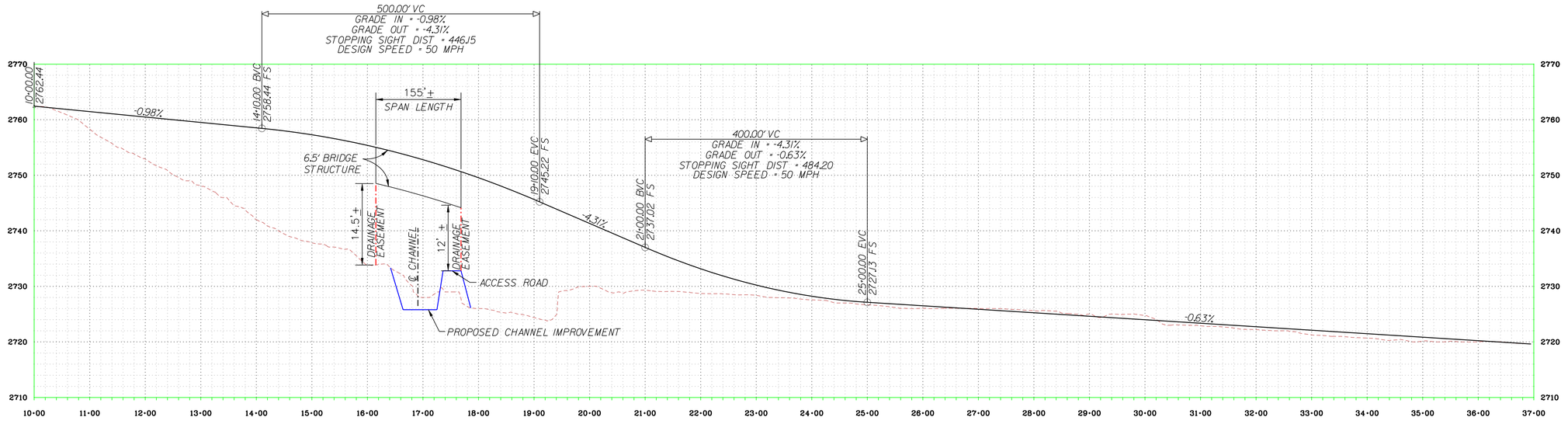
ASSUMED CATCH BASIN OPENING = 3.5 FT
ASSUMED FLOW DEPTH AT GUTTER = 0.5 FT

Q = 6.51 > 1 CFS

THEREFORE, DESIGN CATCH BASIN OPENING LENGTH = 3.5 FT

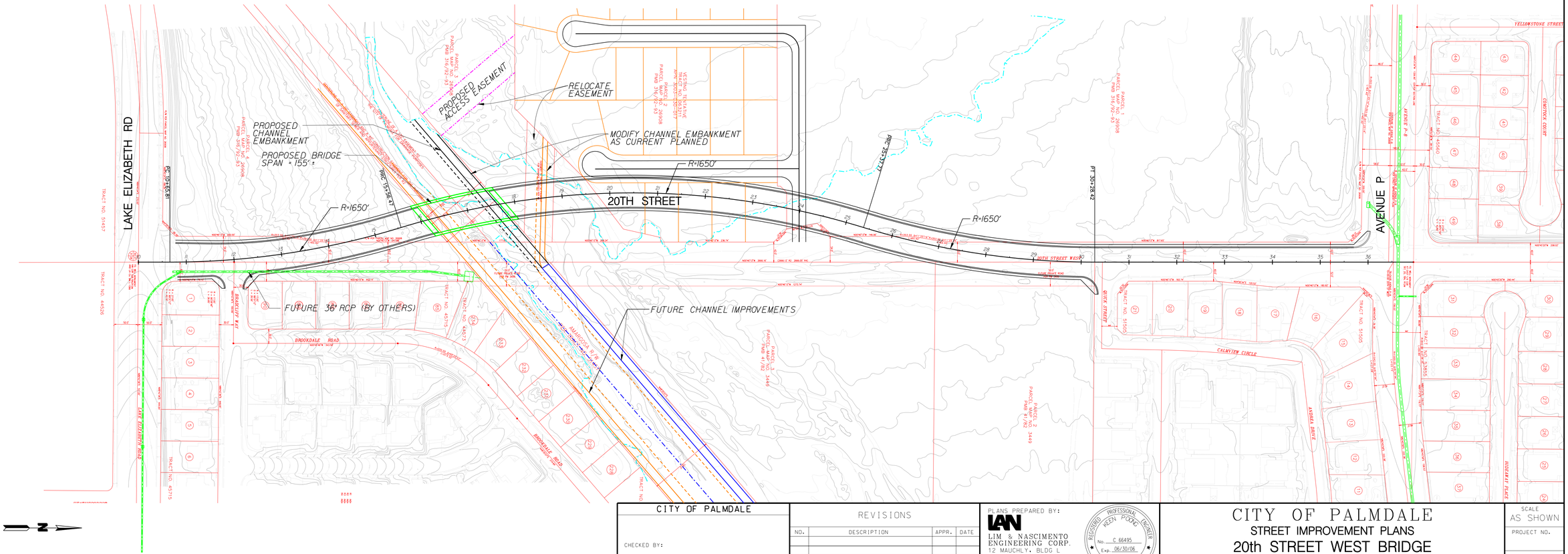
Attachment E
Other Considered Alternatives

VERTICAL DESIGN SPEED = 50 MPH



PROFILE

HORIZONTAL DESIGN SPEED = 50 MPH



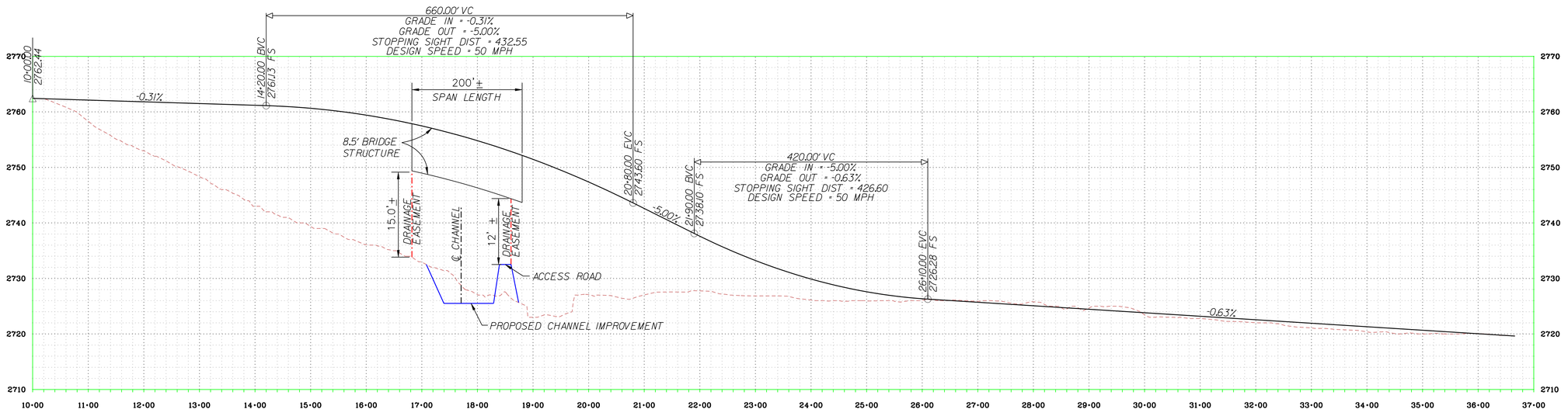
CITY OF PALMDALE	REVISIONS			
CHECKED BY:	NO.	DESCRIPTION	APPR.	DATE
PLAN CHECK ENGINEER DATE				

PLANS PREPARED BY:
LAN
LIM & NASCIMENTO ENGINEERING CORP.
12 MAUCHLY, BLDG L
IRVINE, CAL 92618
(949) 450-2800

REGISTERED PROFESSIONAL ENGINEER KEEN POONG No. C 66495 Exp. 06/30/06 CIVIL STATE OF CALIFORNIA

CITY OF PALMDALE
STREET IMPROVEMENT PLANS
20th STREET WEST BRIDGE
ALTERNATIVE 1

SCALE AS SHOWN
PROJECT NO.
SHT. OF XX



CITY OF PALMDALE	REVISIONS			
CHECKED BY:	NO.	DESCRIPTION	APPR.	DATE
PLAN CHECK ENGINEER DATE				

PLANS PREPARED BY:
LIM & NASCIMENTO ENGINEERING CORP.
12 MAUCHLY, BLDG L
IRVINE, CAL 92618
(949) 450-2800

REGISTERED PROFESSIONAL ENGINEER — KEEN POONG — No. C 66495 — Exp. 06/30/06 — CIVIL — STATE OF CALIFORNIA

CITY OF PALMDALE
STREET IMPROVEMENT PLANS
20th STREET WEST BRIDGE
ALTERNATIVE 2

SCALE AS SHOWN
PROJECT NO.
SHT. OF XX

Attachment F
Project Cost Estimate

CITY OF PALMDALE
20th Street West Bridge: Preferred Alternative
Project Cost Estimate
6/27/2006
Preliminary Engineer's Estimate

* Note: This cost estimate is base on preliminary engineering study only. The number is subjected to change.

Item	Description	Quantity	Unit	Unit Price	Price
STREET IMPROVEMENTS					**$5,231,000**
1	Clearing and Grubbing	1	LS	$15,000	$15,000
2	Mobilization	1	LS	$50,000	$50,000
3	Unclassified Excavation	1,610	CY	$10	$16,100
4	Imported Borrow	25,500	CY	$15	$382,500
5	Construct Asphalt Concrete Pavement	5,000	Tons	$60	$300,000
6	Construct 2" Tire Modified Asphalt Concrete (TMAC)	1,650	Tons	$80	$132,000
7	Construct Crushed Aggregate Base	4,700	Tons	$20	$94,000
8	Construct 8" Curb & Gutter	4,500	LF	$25	$112,500
9	Construct PCC Sidewalk	22,900	SF	$6	$137,400
10	Drainage System	1	LS	$150,500	$150,500
11	Traffic Signals	1	LS	$200,000	$200,000
12	Signing and Striping	1	LS	$40,000	$40,000
13	Street Lighting	1	LS	$100,000	$100,000
14	Bridge Structure	9,606	SF	$280	$2,700,000
15	Architectural Features	1	LS	$500,000	$500,000
16	Channel Improvement	1	LS	$200,000	$200,000
17	Landscaping	16,200	SF	$5	$81,000
18	Traffic Control	1	LS	$20,000	$20,000
				PROJECT SUBTOTAL	$5,231,000
				CONTINGENCY (25%)	$1,307,750
				PROJECT TOTAL CONSTRUCTION	**$6,538,750**
19	Right of Way Acquisition	26,846	SF	$7.00	$187,922
20	Slope Easement	24,866	SF	$3.50	$87,031
				RIGHT OF WAY TOTAL	**$274,953**
21	PS&E Design (8%)	1	LS	$523,100	$523,100
22	Construction Management (10%)	1	LS	$653,875	$653,875
				ENGINEERING TOTAL	**$1,176,975**
				PROJECT TOTALWITH R/W AND ENGINEERING COST	**$7,990,678**

ALTERNATIVE 1 (LINED CHANNEL - HARD BOTTOM)

BRIDGE GENERAL PLAN ESTIMATE ■ **or PLANNING ESTIMATE** □

DS-D-0016

STRUCTURE	BR. NO.		RCVD. BY		ESTIMATING GROUP	
20TH STREET WEST BRIDGE					IN	
TYPE	DIST.	CO.	RTE.	P.M.	OUT	
CIP/PS CONC BOX GIRDER						

LENGTH 120.083 **FT** x WIDTH 80 **FT** = AREA 9606.64 SQ FT

DESIGN SECTION _____ QUANTITIES BY SX DATE 3/15/06 ESTIMATE NO. 1

PROJECT INCLUDES 1 STRUCTURE(S) QUANTITIES CHCKED.BY _____ DATE _____ PRICED BY SX

AND $ _____ROADWORK CHARGE UNIT AND EA _____ COST INDEX _____

	CONTRACT ITEMS	UNIT	QUANTITY	PRICE	AMOUNT
1	STRUCTURE EXCAVATION (BRIDGE)	CY	2930	$90.00	$263,700
2	STRUCTURE BACKFILL (BRIDGE)	CY	2586	$70.00	$181,020
3	STRUCTURAL CONCRETE (BRIDGE FOOTING)	CY	318	$500.00	$159,000
4	STRUCTURAL CONCRETE (BRIDGE)	CY	1,150	$600.00	$690,000
5	STRUCTURAL CONC, APPROACH SLAB (TYPE N)	CY	254	$550.00	$139,700
6	JOINT SEAL (TYPE B, MR=50)	FT	230	$100.00	$23,000
7	BAR REINFORCING STEEL (BRIDGE)	LB	318300	$1.20	$381,960
8	24" WELDED STEEL PIPE CASING (BRIDGE)	FT	150	$110.00	$16,500
9	TUBULAR HANDRAILING	FT	300	$115.00	$34,500
10	CONCRETE BARRIER (TYPE 26)	FT	300	$250.00	$75,000

SUB TOTAL	$1,964,380
MOBILIZATION (10%)	$196,438
SUB TOTAL BRIDGE ITEMS	$2,160,818
CONTINGENCIES (25 %)	$540,205
BRIDGE TOTAL	$2,701,023
SUPPLEMENTAL WORK	
WORK BY RAILROAD OR UTILITY FORCES	
GRAND TOTAL	**$2,701,023**
FOR BUDGET PURPOSES - USE	**$2,702,000**

ROUTING

1. DESIGN SECTION _____
2. DESIGN A SUPERVISOR
3. DESIGN B SUPERVISOR
4. PLANNING

_____

_____

_____

ESTIMATING - LAST

COMMENTS **$280.00 PER FT^2**

Attachment G
Right-of-Way Requirement

LEGEND

PROPOSED R/W

SLOPE EASEMENT

SLOPE EASEMENT
AREA=9791 SQ FT

PROP R/W
AREA=25603 SQ FT

SLOPE EASEMENT
AREA=9739 SQ FT

PROP R/W
AREA=1243 SQ FT

SLOPE EASEMENT
AREA=5336 SQ FT

LAKE ELIZABETH RD

20TH STREET WEST

BRADCLIFF WAY

BROOKDALE ROAD

LAKE ELIZABETH ROAD

AMARGOSA R/W
PER TRACT NO. 54147

FUTURE PRIVATE ROAD
PER PM 3449

PARCEL 4
PARCEL MAP NO. 26908
PMB 316/92-93

PARCEL 3
PARCEL MAP NO. 3449
PMB 41/82

TRACT NO. 45715

TRACT NO. 44573

CENTERLINE OF A 20' EASEMENT AND A 40' CONSTRUCTION EASEMENT FOR THE PURPOSES OF SANITARY SEWER AND APPURTENANT STRUCTURES PER R2

CENTERLINE OF A 135' EASEMENT TO THE CITY OF PALMDALE FOR DRAINAGE PURPOSES

EASEMENT TO THE CITY OF PALMDALE FOR DRAINAGE PURPOSES PER R2

R/W PER PARCEL MAP NO. 26908

CITY OF PALMDALE	REVISIONS			
CHECKED BY:	NO.	DESCRIPTION	APPR.	DATE
PLAN CHECK ENGINEER DATE				

PLANS PREPARED BY:
LIM & NASCIMENTO ENGINEERING CORP.
12 MAUCHLY, BLDG L
IRVINE, CAL 92618
(949) 450-2800

REGISTERED PROFESSIONAL ENGINEER
KEEN POONG
No. C 66495
Exp. 06/30/06
CIVIL
STATE OF CALIFORNIA

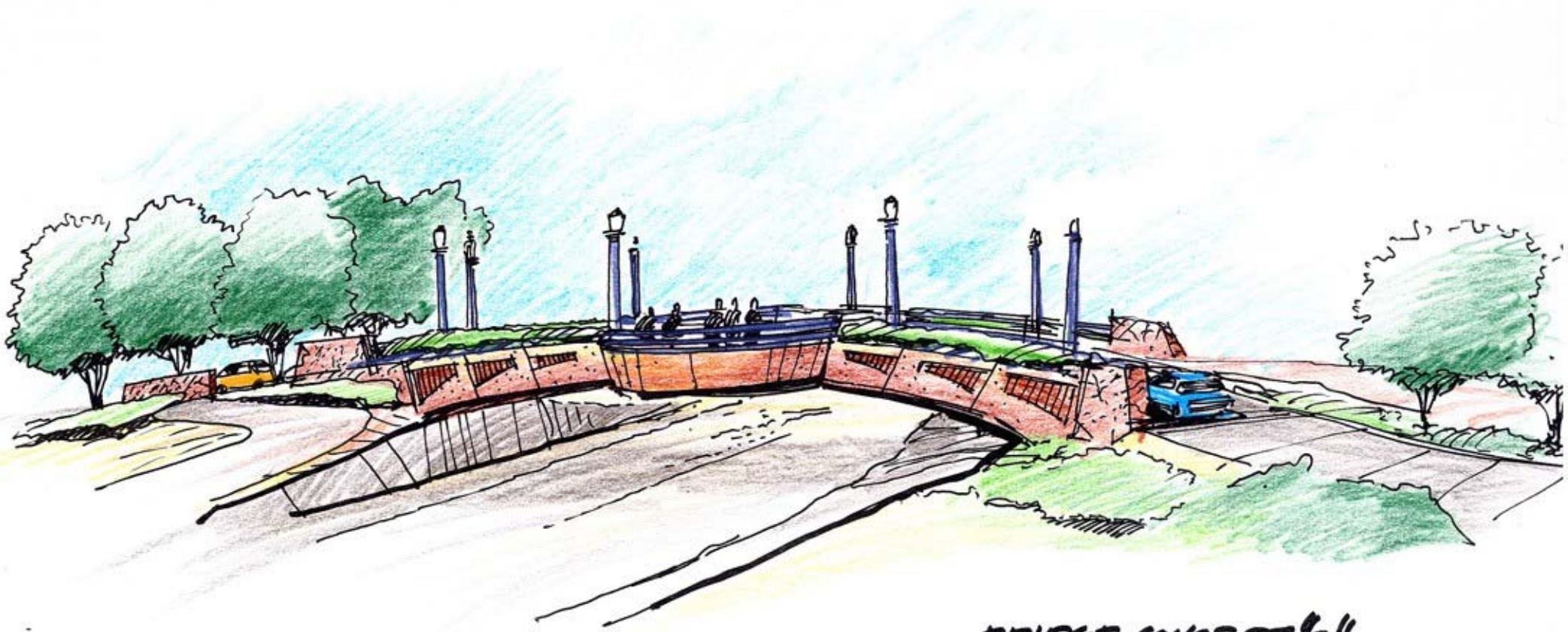
CITY OF PALMDALE
STREET IMPROVEMENT PLANS
20th STREET WEST BRIDGE
RIGHT-OF-WAY REQUIREMENT

SCALE
AS SHOWN

PROJECT NO.

SHT. OF XX

Attachment H
Architectural Concept



BRIDGE CONCEPT 'E'
20th STREET WEST BRIDGE
1" = 20'-0" 4 APRIL '06

Attachment I
Bridge Type Selection Report

Attachment J
Environmental Report

Attachment K
Hydraulic Report

Hydraulic Analysis and Scour Evaluation for the

20th Street Bridge Over Amargosa Creek

City of Palmdale, CA

Prepared for

LAN Engineering Corporation
12-L Mauchly
Irvine, CA 92618

Prepared by

WEST Consultants, Inc.
16870 W. Bernardo Dr.
Suite 340
San Diego, CA 92127
(858) 487-9378

WEST CONSULTANTS, INC.

REGISTERED PROFESSIONAL ENGINEER
DAVID S. SMITH
No. C056132
Exp. 12/31/06
CIVIL
STATE OF CALIFORNIA

March 2006

WEST No. 672C01

TABLE OF CONTENTS

1 Introduction

1.1 Study Overview

WEST Consultants, Inc. (WEST) has performed preliminary hydraulic and scour analyses for the 20th Street Bridge over Amargosa Creek as a subconsultant to LAN Engineering Corporation (LAN). The proposed bridge is located on the west side of the City of Palmdale in Los Angeles County. The approximate location of the proposed 20th Street Bridge over Amargosa Creek is illustrated in Figure 1-1.

The U.S. Army Corps of Engineers' HEC-RAS ("River Analysis System") computer program, Version 3.1.3 (Hydrologic Engineering Center, 2002), was used to compute water surface elevations and flow velocities for the Los Angeles County Capital Flood (Q_{CAP}). The Capital Flood represents the 50-year discharge for a recently burned watershed and includes bulking for sediment.

Figure 1-1. Site Map

1.2 Data Collection and Review

Project hydrology was obtained from two reports by Pacific Advanced Civil Engineering (PACE), Inc.—April 2003 (revised August 2003) and June 2003—for the design of soil cement channel protection for Amargosa Creek between 10th and 20th Street. The 100-year and Capital Flood discharge estimates were provided in the PACE reports, originally obtained from the City of Palmdale.

LAN provided the channel design concept in the vicinity of the 20th Street Bridge with a minimum clearance through the bridge of 8.25 feet along the bikeway/access road. The channel concept consists of transitioning from the trapezoidal channel at station 244+87.9 to a smaller compound rectangular channel to accommodate access roads on both sides of the channel that would pass under the bridge (see Figure 1-2). Between station 244+87.9 and station 245+68.3 the cross section shape transitions from trapezoidal with a top width of 95 feet to rectangular with a top width of 63 feet. From station 245+68.3 to 247+68.6, the access road gradually drops from the channel bank at station 245+68.3 to 1.75 feet above the channel invert at station 247+68.6. The compound rectangular channel shape is maintained under the bridge from station 247+68.6 continuing upstream to station 251+00.

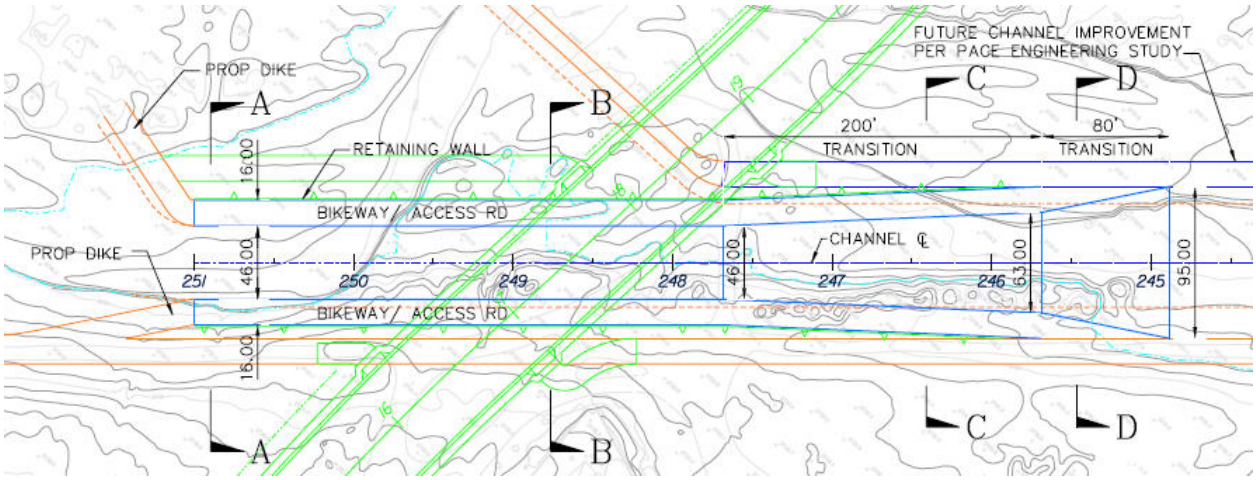


Figure 1-2. Amargosa Creek Channel Concept at Proposed 20th Street Bridge

The narrowing of the channel at 20th Street is intended to reduce bridge construction costs. The low chord elevation of the bridge will be established based on the results of this study, with a minimum clearance through the bridge of 8.25 feet for vehicular clearance along the access roads under the bridge.

1.3 Acknowledgements

Mr. David Smith, P.E. of WEST Consultants, Inc. was the project manager for this study. Ms. Daniela Todesco assisted with the field reconnaissance and created the HEC-RAS models. Mr. Martin Teal, P.E., P.H. provided a quality assurance review.

Mr. Keenyong Poong, P.E. of LAN Engineering Corporation (LAN) provided the bridge concept alternative and topography for the study. The project manager at LAN was Mr. James Faber, P.E. Mr. Derek Karimoto of PACE, Inc. provided clarifications of interim and ultimate channel bank and bottom elevations in the vicinity of the 20th Street Bridge.

2 Hydraulic Analysis

WEST performed hydraulic modeling for Amargosa Creek based on the Capital Flood discharge of 3,695 cfs and the 100-year discharge of 2,350 cfs. The U.S. Army Corps of Engineers' HEC-RAS computer program was used to compute water surface elevations and other hydraulic values in the vicinity of the bridge.

2.1 Hydraulic Model Development

Existing, ultimate, and interim condition hydraulics were evaluated by PACE in their April/August 2003 study for Amargosa Creek between 20th Street (not including the proposed 20th Street bridge) and 10th Street. In this study, interim and ultimate conditions have been evaluated in the vicinity of the 20th Street bridge. The HEC-RAS stationing used in this report for interim and ultimate conditions (described below) is consistent with the PACE stationing for existing conditions.

The proposed bridge is located between stations 249+22.7 and 2448+10 as shown in Figure 1-2. The bridge was not included in the models because there are no piers, the abutments are outside of the channel, and the low chord is above the maximum computed water surface. Depth and velocity results at the upstream and downstream bridge face are obtained at cross sections 249+22.7 and 248+10, respectively. The centerline of the bridge is located at station 248+66.4 and, due to the skew angle, the bridge is approximately 109 feet wide in the direction of flow.

2.1.1 Ultimate Condition

The ultimate condition described in the June 2003 PACE report includes soil cement slope protection downstream of the 20th Street alignment and 4-foot drop structures at approximately 800-foot intervals for a total of 6 drops. During construction of the 20th Street Bridge, the channel geometry will be modified upstream of station 244+87.9 to station 251+00 as shown in Figure 1-2. Although not shown in Figure 1-2, the ultimate condition has been modeled to include a drop structure just downstream of 20th Street, with the drop structure crest at station 247+68.6 and toe at station 247+55. Upstream of the drop structure, the channel slope will be the same as the existing slope which is approximately 0.0081. Downstream of the drop structure the channel slope will be 0.004, as recommended in the PACE report.

2.1.2 Interim Condition

The interim condition described in the PACE 2003 report includes soil cement slope protection downstream of the 20th Street alignment with a channel slope of 0.0081. During construction of the 20th Street Bridge, the channel geometry will be modified upstream of station 244+87.9 to station 251+00 as shown in Figure 1-2.

2.1.3 Channel Roughness

Two different channel roughness scenarios were considered—a higher channel roughness scenario for evaluating freeboard and a lower roughness scenario for evaluating scour. For the high roughness scenario a Manning's *n* value of 0.035 was assumed for the channel, and 0.025 for the low roughness scenario. For the high roughness scenario a Manning's *n* value of 0.03 was assumed for soil cement surfaces and 0.014 for the low roughness scenario. In both scenarios, the Manning's *n* value for concrete surfaces was 0.014.

2.1.4 Flow Regime and Boundary Conditions

A mixed flow regime (sub- and supercritical flow) was applied to all model runs because the flow regime was close to critical depth, but when evaluating freeboard any cross section with a supercritical solution was assumed to be at critical depth. A normal depth boundary condition (slope = 0.0081) was assumed at the upstream and downstream model boundaries for interim conditions and the upstream boundary for ultimate conditions (these conditions are described below). A normal depth boundary condition (slope = 0.004) was assumed at the downstream model boundary for ultimate conditions.

2.2 Hydraulic Model Results

HEC-RAS hydraulic model results for interim and ultimate conditions are provided in Appendix A, including profile plots, output tables, and model cross sections.

2.2.1 Freeboard Evaluation

The freeboard along Amargosa Creek upstream and downstream of the 20th Street Bridge for the Capital Flood discharge is summarized in Table 2-1. Results are presented for interim and ultimate conditions based on the higher channel *n* value of 0.035. Table 2-2 summarizes freeboard for the 100-year discharge.

Table 2-1. Capital Flood Discharge Freeboard

River Station	Discharge (cfs)	Bank Elevation (ft)	Channel Invert Elevation (ft)	Water Surface Elevation[1] (ft)		Freeboard[2] (ft)	
				Interim	Ultimate	Interim	Ultimate
251+00	3695	2734.8	2724.48	2729.36	2729.36	5.44	5.44
249+22.7 (approx. U/S bridge face)	3695	2733.36	2723.04	2727.93	2727.93	5.43	5.43
248+10 (approx. D/S bridge face)	3695	2732.45	2722.13	2727.74	2727.05	4.71	5.40
247+68.6	3695	2732.12	2721.8	2727.69	2726.68	4.43	5.44
247+01.8* (interpolated)	3695	2730.64	varies[3]	2727.49	n/a[4]	3.15	n/a[4]
246+68.4* (interpolated)	3695	2729.91		2727.37		2.54	
245+68.3	3695	2727.29		2724.97	2722.73	2.32	4.56
244+87.9	3695	2726.66		2723.74	2722.71	2.92	3.95
243+00.1	3695	2725.17		2722.61	2721.98	2.56	3.19

1. Shaded values represent the critical water surface elevation--HEC-RAS computed supercritical solutions at these locations
2. Freeboard to top of bank. At bridge, top of bank = bridge low chord = 10.32 feet above channel invert.
3. Invert elevations are different for interim and ultimate conditions downstream of cross section 24768.6
4. Interpolated cross section locations are different for ultimate conditions downstream of the drop structure

Table 2-2. 100-Year Flood Discharge Freeboard

River Station	Discharge (cfs)	Bank Elevation (ft)	Channel Invert Elevation (ft)	Water Surface Elevation[1] (ft)		Freeboard[2] (ft)	
				Interim	Ultimate	Interim	Ultimate
251+00	2350	2734.8	2724.48	2728.27	2728.27	6.53	6.53
249+22.7 (approx. U/S bridge face)	2350	2733.36	2723.04	2726.84	2726.84	6.52	6.52
248+10 (approx. D/S bridge face)	2350	2732.45	2722.13	2726.53	2725.93	5.92	6.52
247+68.6	2350	2732.12	2721.8	2726.46	2725.59	5.66	6.53
247+01.8* (interpolated)	2350	2730.64	varies[3]	2726.07	n/a[4]	4.57	n/a[4]
246+68.4* (interpolated)	2350	2729.91		2724.89		5.02	
245+68.3	2350	2727.29		2723.73	2721.55	3.56	5.74
244+87.9	2350	2726.66		2723.07	2721.36	3.59	5.30
243+00.1	2350	2725.17		2721.54	2720.61	3.63	4.56

1. Shaded values represent the critical water surface elevation--HEC-RAS computed supercritical solutions at these locations
2. Freeboard to top of bank. At bridge, top of bank = bridge low chord = 10.32 feet above channel invert.
3. Invert elevations are different for interim and ultimate conditions downstream of cross section 24768.6
4. Interpolated cross section locations are different for ultimate conditions downstream of the drop structure

2.2.1.1 Hydraulic Design Manual Freeboard Criteria

According to the Los Angeles County Department of Public Works (LACDPW) Hydraulic Design Manual, for velocities less than 35 feet per second, channel freeboard of 2 feet is required for rectangular channels and 2.5 feet for trapezoidal channels. Based on this criteria, the proposed bridge and channel meet freeboard for both interim and ultimate conditions.

2.2.1.2 Sedimentation Manual Freeboard Criteria

According to the LACDPW Sedimentation Manual, the required freeboard for leveed reaches is defined as:

$FB = Y_{agg} + Y_{ga} + Y_{se} + 1/2h$

Where:	FB	=	Total freeboard
	Y_{agg}	=	Long-term aggradation
	Y_{ga}	=	General aggradation
	Y_{se}	=	Superelevation
	h	=	bed form height

The project reach is essentially straight, so the superelevation term (Y_{se}) is negligible. In addition, the long-term (Y_{agg}) and general aggradation (Y_{ga}) are assumed to be negligible because in the ultimate condition no net aggradation or degradation is expected to occur due to the drop structure spacing and channel slopes planned by PACE. The relationship between the mean channel velocity and the bed form height is shown on the graph in Appendix Q-9 of the LACDPW Sedimentation Manual, included below as Figure 2-1.

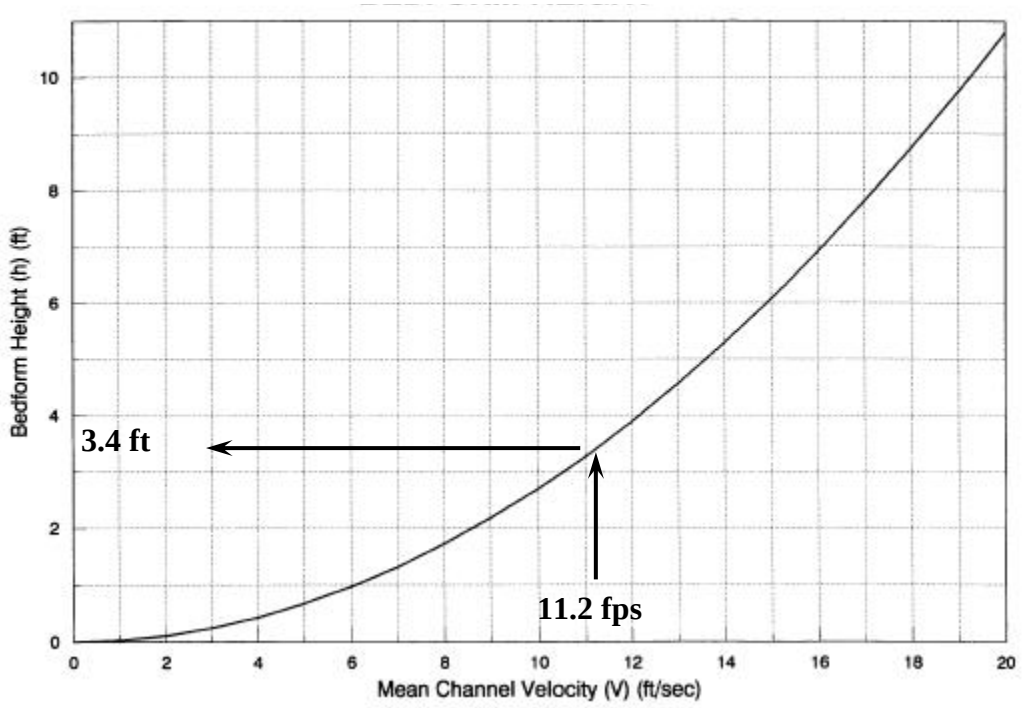


Figure 2-1. Bed Form Height, *h*

For a mean velocity of 11.2 feet per second for interim and ultimate conditions, the bed form height is approximately 3.4 feet. Therefore, the parameter 1/2*h* is approximately 1.7 feet. With all other freeboard terms equal to zero the total freeboard, then, is also 1.7 feet.

2.2.1.3 Freeboard Criteria Selection

The freeboard computed using the LACDPW Hydraulic Design Manual is higher than the freeboard computed using the Sedimentation Manual, therefore the Hydraulic Design Manual freeboard of 2 feet for rectangular sections and 2.5 feet for trapezoidal sections was used for evaluating the project.

Table 2-3 summarizes the channel shape at each cross section, freeboard requirement based on cross section shape (rectangular versus trapezoidal), and the difference between computed and required freeboard.

Table 2-3. Freeboard Evaluation By Cross Section Shape

River Station	Cross Section Shape	Required Freeboard (ft)	Computed Freeboard[1] (ft)		Difference (Computed - Required)	
			Interim	Ultimate	Interim	Ultimate
251+00	rectangular	2	5.44	5.44	3.44	3.44
249+22.7 (approx. U/S bridge face)	rectangular	2	5.43	5.43	3.43	3.43
248+10 (approx. D/S bridge face)	rectangular	2	4.71	5.40	2.71	3.40
247+68.6	rectangular	2	4.43	5.44	2.43	3.44
247+01.8* (interpolated)	rectangular	2	3.15	n/a[2]	1.15	n/a[2]
246+68.4* (interpolated)	rectangular	2	2.54		0.54	
245+68.3	rectangular	2	2.32	4.56	0.32	2.56
244+87.9	trapezoidal	2.5	2.92	3.95	0.42	1.45
243+00.1	trapezoidal	2.5	2.56	3.19	0.06	0.69

1. Freeboard to top of bank. At bridge, top of bank = bridge low chord = 10.32 feet above channel invert
2. Interpolated cross section locations are different for ultimate conditions downstream of the drop structure.

3 Scour Analysis

Potential scour in the reach with the proposed bridge was evaluated using the procedures outlined in the LACDPW Sedimentation Manual to calculate slope protection and/or cut-off wall toe-down depths. These scour estimates were also compared to recommendations in the LACDPW Hydraulic Design Manual.

Scour toe-down depths were computed for both interim and ultimate conditions. As described in previous sections, the difference between interim and ultimate conditions is the addition of a drop structure at cross section 247+68.6 in the ultimate condition and a reduced channel slope downstream. On the average, ultimate condition velocities are slightly higher than interim conditions through the project reach (average velocity of 14.5 feet per second compared to 13.6 feet per second). Therefore, the toe-down depth calculations in this report are based on ultimate conditions. The following sections describe the recommended toe-down depths for the project reach between cross sections 244+87.9 and 251+00.

3.1 LACDPW Sedimentation Manual Toe-Down Depth

According to the LACDPW Sedimentation Manual, the requirement for toe-down is the total cumulative channel adjustments possible from long-term degradation, general scour, bend scour, local scour, low-flow incisement, and bed forms:

$$Z_{tot} = Z_{deg} + Z_{gs} + Z_{ls} + Z_{bs} + Z_i + 1/2h$$

Where:	Z_{tot}	=	Total potential vertical adjustment
	Z_{deg}	=	Long-term degradation
	Z_{gs}	=	General scour
	Z_{ls}	=	Local scour
	Z_{bs}	=	Bend scour
	Z_i	=	Low flow incisement
	h	=	bed form height

3.1.1 Long-term Degradation (Z_{deg})

Long-term degradation is expected to be negligible in the project reach. In the ultimate condition, drop structures will be spaced every 800 feet including a drop structure located just downstream of the proposed bridge.

3.1.2 General Scour (Z_{gs})

General scour was estimated using Appendix Q-3 of the LACDPW Sedimentation Manual, included below as Figure 3-1. Based on an average channel velocity of 14.5 feet per second, the general scour is estimated to be approximately 3.7 feet.

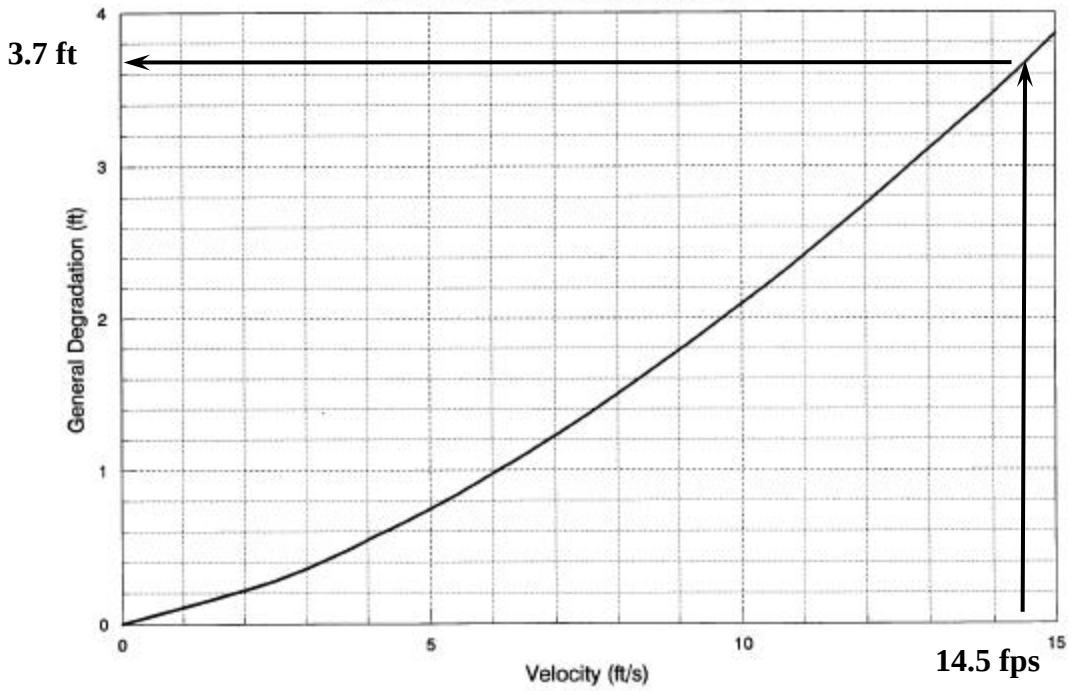


Figure 3-1. General Degradation, Z_{gs}

3.1.3 Local Scour (Z_{ls})

Local scour occurs in the vicinity of an obstruction to flow, such as bridge piers, embankments, and contractions. The proposed bridge does not have any piers and the bridge abutments do not constrict the flow, so local scour is expected to be minimal. According to the LACDPW Sedimentation Manual, the levee toe-down depth should be increased by 2 feet where the flow may possibly carry large debris (tree logs, boulders, etc.) to account for local scour. Therefore, the local scour will be assumed to be 2 feet.

3.1.4 Bend Scour (Z_{bs})

In the vicinity of the 20th Street Bridge, Amargosa Creek is essentially straight. Therefore, bend scour is not expected.

3.1.5 Low Flow Incisement (Z_i)

For design purposes, the LACDPW Sedimentation Manual recommends using 2 feet to estimate the potential low flow incisement where field measurements are not available. Therefore, the low flow incisement will be assumed to be 2 feet.

3.1.6 Bed Form Height (*h*)

The relationship between the mean channel velocity and the bed form height is shown on the graph in Appendix Q-9 of the LACDPW Sedimentation Manual, included below as Figure 3-2.

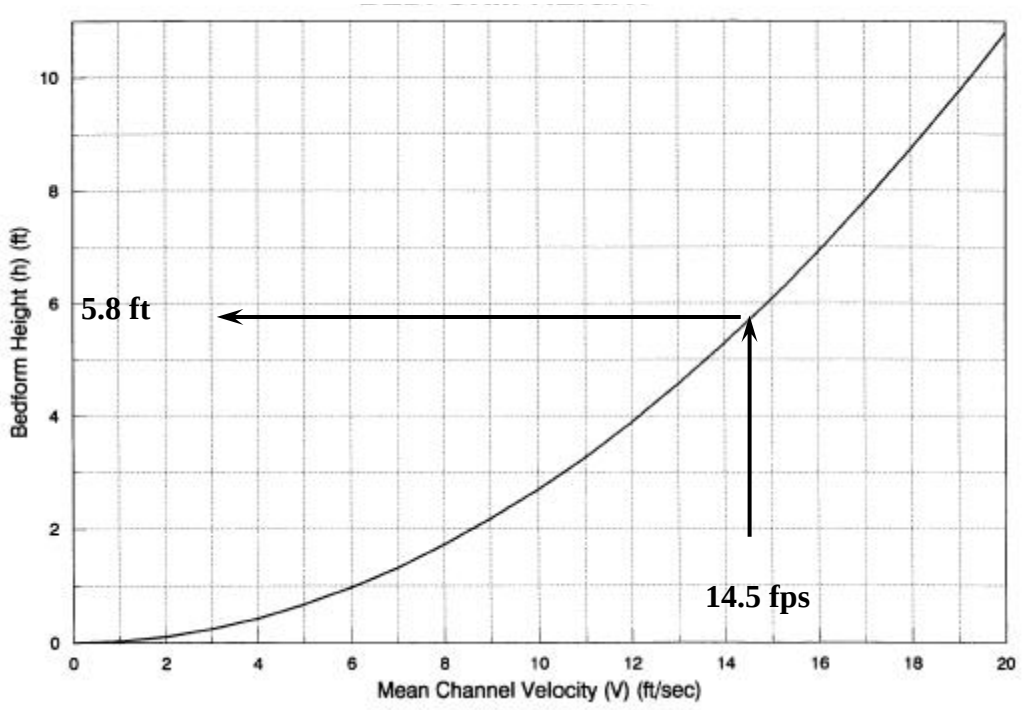


Figure 3-2. Bed Form Height, *h*

For a mean velocity of 14.5 feet per second, the bed form height is approximately 5.8 feet. Therefore, the parameter 1/2*h* is 2.9 feet.

3.1.7 Total Potential Vertical Adjustment (Z_{tot})

Adding the scour components above, the total vertical adjustment is:

$Z_{tot} = Z_{deg} + Z_{gs} + Z_{ls} + Z_{bs} + Z_i + 1/2h$
$Z_{tot} = 0 \text{ ft.} + 3.7 \text{ ft.} + 2 \text{ ft.} + 0 \text{ ft.} + 2 \text{ ft.} + 2.9 \text{ ft.}$
$Z_{tot} =$ 10.6 feet (say, 11 feet)

3.2 Toe-Down Depth Recommendations

The LACDPW Hydraulic Design Manual requires a cut off depth of 10 feet when velocities are between 10 and 15 feet per second. For an average velocity of 14.6 feet per second for the project reach, a cut off depth of 10 feet would be required. This is very close to the toe-down

depth of 11 feet calculated using the LACDPW Sedimentation Manual (see Section 3.1), therefore we recommend using a cut off depth of 11 feet.

The toe-down depth of 11 feet should be applied to both interim and ultimate conditions. Table 3-1 below summarizes recommended toe burial elevations by ultimate condition cross section.

Table 3-1. Toe-Down Elevation Recommendations

River Station	Channel Invert Elevation	Toe-Down Elevation[1]
251+00	2724.48	2713.48
249+22.7	2723.04	2712.04
248+10	2722.13	2711.13
247+68.6	2721.80	2710.80
247+55	2717.91	2706.91
245+68.3	2717.16	2706.16
244+87.9	2716.84	2705.84

1. Toe-down depth of 11 feet based on Q_{CAP} = 3,695 cfs

4 Hard Bottom Alternative

As an alternative to providing scour protection to a depth of 11 feet, a hard-bottom channel has been proposed between stations 251+00 and 247+68.6 (station of the ultimate condition drop structure). The material for the bottom protection would be either soil cement or concrete.

There were a total of four model runs made for the hard bottom alternative—a high and low roughness scenario for interim and ultimate conditions. For the high roughness scenario, a Manning's *n* value of 0.035 was assumed for the natural channel and 0.025 for the low roughness scenario. Soil cement was assumed to have a Manning's *n* value of 0.03 for the high roughness scenario and 0.014 for the low roughness scenario. In both scenarios, the Manning's *n* value for concrete surfaces was 0.014. Hydraulic calculations for the hard bottom alternative are provided in Appendix B.

4.1 Freeboard

The freeboard criteria for this project were discussed in Chapter 2. The water surface elevations for the hard bottom alternative are lower than the soft bottom alternative, so there is more freeboard for the hard bottom alternative. Tables 4-1, 4-2, and 4-3 summarize the freeboard for the hard bottom alternative. The hydraulic results presented in Tables 4-1 to 4-3 assume the channel bottom material in the hard bottom reach is soil cement. If the material is later changed to concrete there will be slightly more freeboard than indicated below.

Table 4-1. Capital Flood Discharge Freeboard (hard bottom alternative)

River Station	Discharge (cfs)	Bank Elevation (ft)	Channel Invert Elevation (ft)	Water Surface Elevation[1] (ft)		Freeboard[2] (ft)	
				Interim	Ultimate	Interim	Ultimate
251+00	3695	2734.8	2724.48	2729.36	2729.36	5.44	5.44
249+22.7 (approx. U/S bridge face)	3695	2733.36	2723.04	2727.93	2727.93	5.43	5.43
248+10 (approx. D/S bridge face)	3695	2732.45	2722.13	2727.66	2727.05	4.79	5.40
247+68.6	3695	2732.12	2721.8	2727.67	2726.68	4.45	5.44
247+01.8* (interpolated)	3695	2730.64	varies[3]	2727.49	n/a[4]	3.15	n/a[4]
246+68.4* (interpolated)	3695	2729.91		2727.37		2.54	
245+68.3	3695	2727.29		2724.97	2722.73	2.32	4.56
244+87.9	3695	2726.66		2723.74	2722.71	2.92	3.95
243+00.1	3695	2725.17		2722.61	2721.98	2.56	3.19

1. Shaded values represent the critical water surface elevation--HEC-RAS computed supercritical solutions at these locations
2. Freeboard to top of bank. At bridge, top of bank = bridge low chord = 10.32 feet above channel invert.
3. Invert elevations are different for interim and ultimate conditions downstream of cross section 24768.6
4. Interpolated cross section locations are different for ultimate conditions downstream of the drop structure

Table 4-2. 100-Year Discharge Freeboard (hard bottom alternative)

River Station	Discharge (cfs)	Bank Elevation (ft)	Channel Invert Elevation (ft)	Water Surface Elevation[1] (ft)		Freeboard[2] (ft)	
				Interim	Ultimate	Interim	Ultimate
251+00	2350	2734.8	2724.48	2728.27	2728.27	6.53	6.53
249+22.7 (approx. U/S bridge face)	2350	2733.36	2723.04	2726.84	2726.84	6.52	6.52
248+10 (approx. D/S bridge face)	2350	2732.45	2722.13	2726.44	2725.93	6.01	6.52
247+68.6	2350	2732.12	2721.8	2726.43	2725.59	5.69	6.53
247+01.8* (interpolated)	2350	2730.64	varies[3]	2726.07	n/a[4]	4.57	n/a[4]
246+68.4* (interpolated)	2350	2729.91		2724.89		5.02	
245+68.3	2350	2727.29		2723.73	2721.55	3.56	5.74
244+87.9	2350	2726.66		2723.07	2721.36	3.59	5.30
243+00.1	2350	2725.17		2721.54	2720.61	3.63	4.56

1. Shaded values represent the critical water surface elevation--HEC-RAS computed supercritical solutions at these locations
2. Freeboard to top of bank. At bridge, top of bank = bridge low chord = 10.32 feet above channel invert.
3. Invert elevations are different for interim and ultimate conditions downstream of cross section 24768.6
4. Interpolated cross section locations are different for ultimate conditions downstream of the drop structure

Table 4-3. Freeboard Evaluation By Cross Section Shape (hard bottom alternative)

River Station	Cross Section Shape	Required Freeboard (ft)	Computed Freeboard[1] (ft)		Difference (Computed - Required)	
			Interim	Ultimate	Interim	Ultimate
251+00	rectangular	2	5.44	5.44	3.44	3.44
249+22.7 (approx. U/S bridge face)	rectangular	2	5.43	5.43	3.43	3.43
248+10 (approx. D/S bridge face)	rectangular	2	4.79	5.40	2.79	3.40
247+68.6	rectangular	2	4.45	5.44	2.45	3.44
247+01.8* (interpolated)	rectangular	2	3.15	n/a[2]	1.15	n/a[2]
246+68.4* (interpolated)	rectangular	2	2.54		0.54	
245+68.3	rectangular	2	2.32	4.56	0.32	2.56
244+87.9	trapezoidal	2.5	2.92	3.95	0.42	1.45
243+00.1	trapezoidal	2.5	2.56	3.19	0.06	0.69

1. Freeboard to top of bank. At bridge, top of bank = bridge low chord = 10.32 feet above channel invert
2. Interpolated cross section locations are different for ultimate conditions downstream of the drop structure.

4.2 End Scour Protection

The upstream end of the cement hard bottom (soil cement or concrete) at station 251+00 should be keyed in to protect against end scour for both interim and ultimate conditions. The preferred method for providing this protection would be to construct the cement slab down at an angle to the depth of potential scour, computed in Chapter 3 as 11 feet. Riprap could also be used as end protection, but it should be keyed in by excavating a trench upstream of the cement slab. The volume of riprap would need to be adequate to provide scour protection to a depth of 11 feet, with appropriate safety factors for launching stone. If the riprap were not keyed in properly there would be a chance it could roll downstream and damage the soil cement or concrete.

The downstream end of the cement hard bottom section at station 247+68.6 should also be keyed in to protect against 11 feet of potential end scour. In the ultimate condition, station 247+68.6 represents the crest of a 4-foot drop structure so the end protection design should reflect the dual purpose of protecting the downstream end of the soil cement/concrete for the interim condition while providing a compatible design for its future role as a drop structure.

5 References

Hydrologic Engineering Center (2002). *HEC-RAS River Analysis System – User's Manual*, Version 3.1, November 2002, U.S. Army Corps of Engineers, Hydrologic Engineering Center, Davis, California.

Los Angeles County Department of Public Works (1982). *Hydraulic Design Manual*, March 1982.

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Pacific Advanced Civil Engineering, Inc. (2003). *Amargosa Creek Soil Cement Channel Improvements Hydrologic & Hydraulic Design Report*, prepared for City of Palmdale, April 2003, revised August 2003.

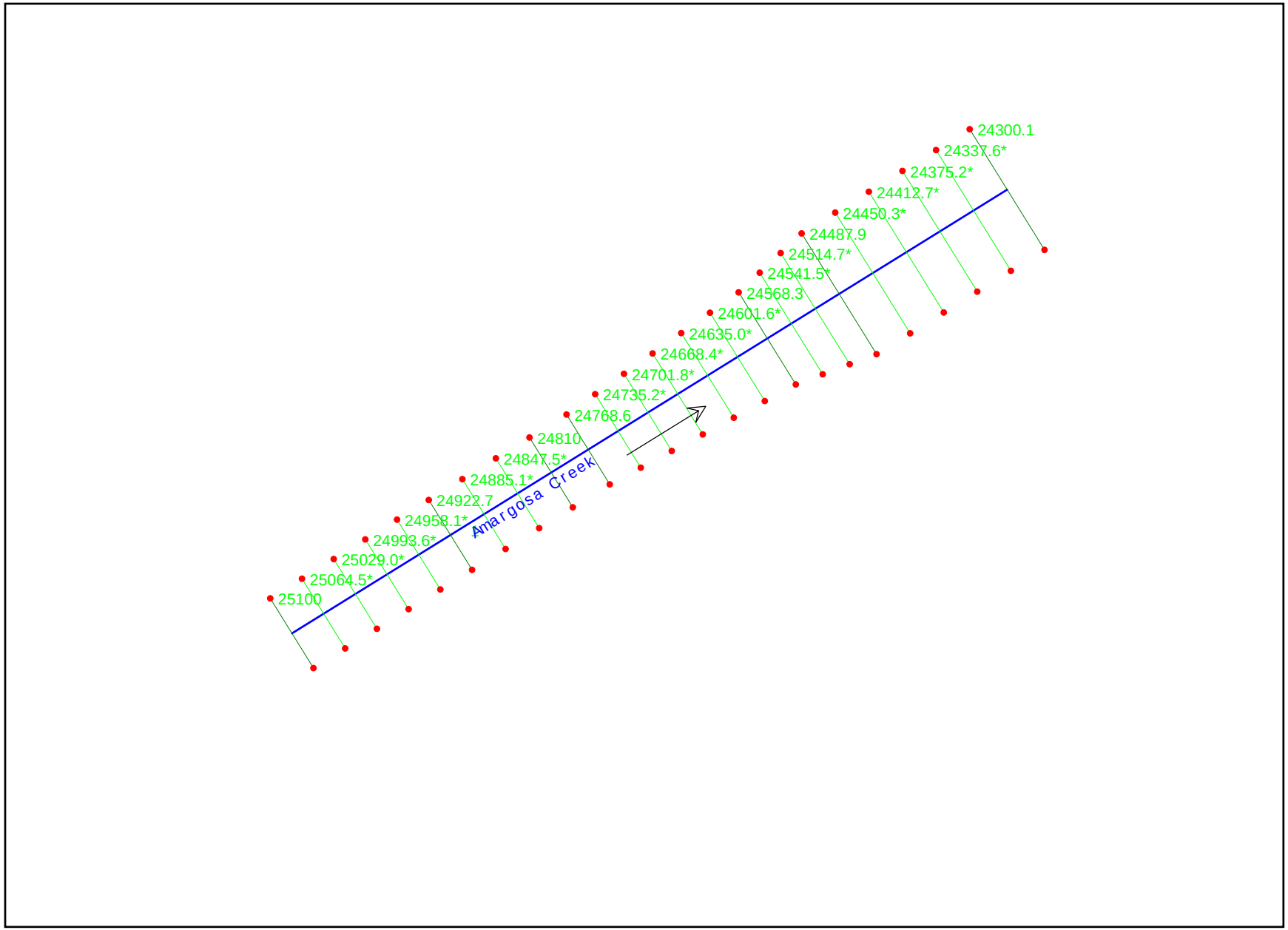
Pacific Advanced Civil Engineering, Inc. (2003). *Amargosa Creek South Side Soil Cement Channel Improvements Hydrologic & Hydraulic Design Report*, prepared for Bayshore L.L.C., June 2003.

Appendix A

Soft Bottom Alternatives
HEC-RAS Model Input/Output

Interim Conditions

High Manning's *n*
(for freeboard evaluation)


24300.1
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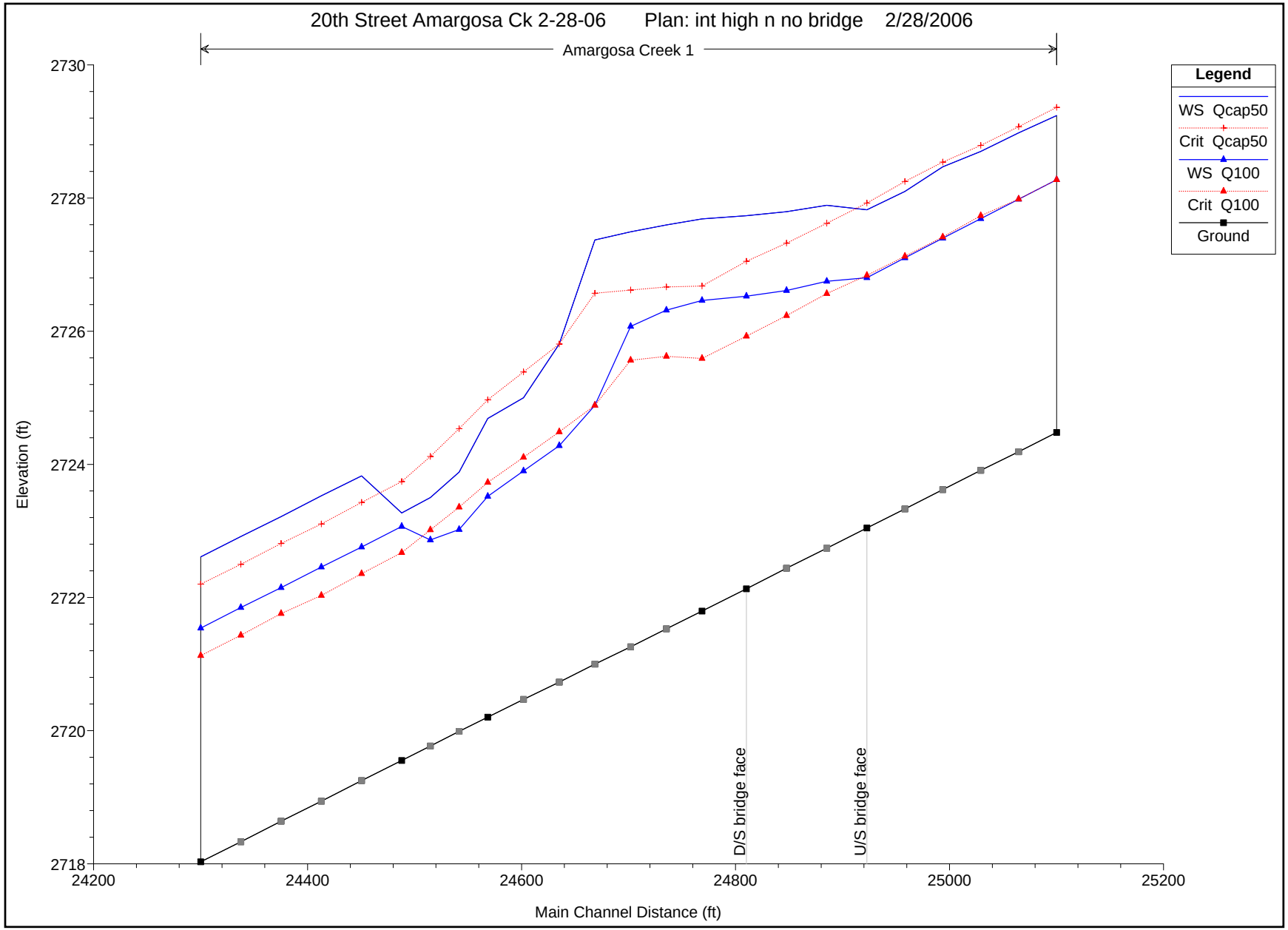
24375.2*
24412.7*
24450.3*
24487.9
24514.7*
24541.5*
24568.3
24601.6*
24635.0*
24668.4*
24701.8*
24735.2*
24768.6
24810
24847.5*
24885.1*
24922.7
24958.1*
24993.6*
25029.0*
25064.5*
25100
Amargosa Creek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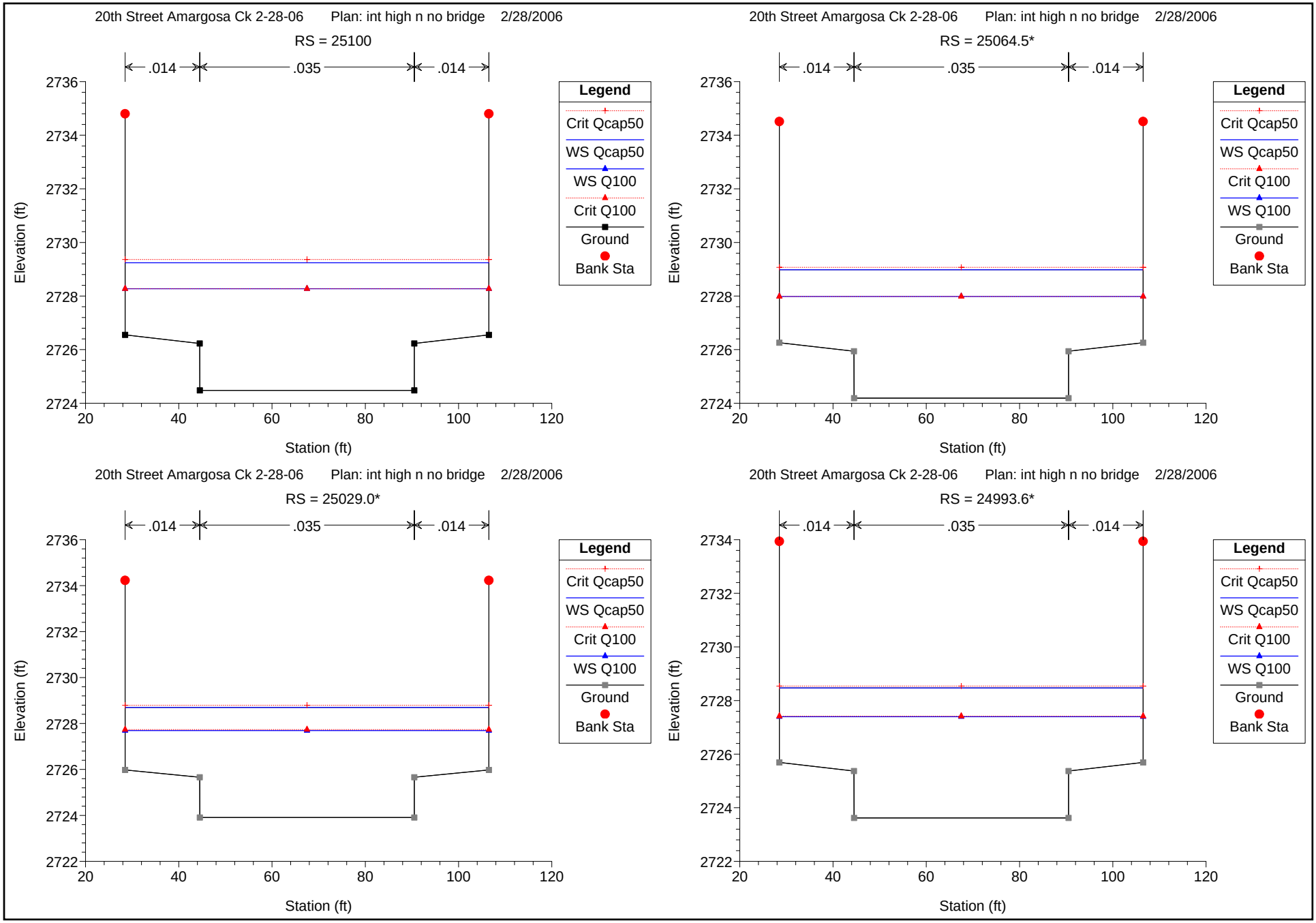
Amargosa Creek 1
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Elevation (ft)
2730
2728
2726
2724
2722
2720
2718
24200
24400
24600
24800
25000
25200
Main Channel Distance (ft)
D/S bridge face
U/S bridge face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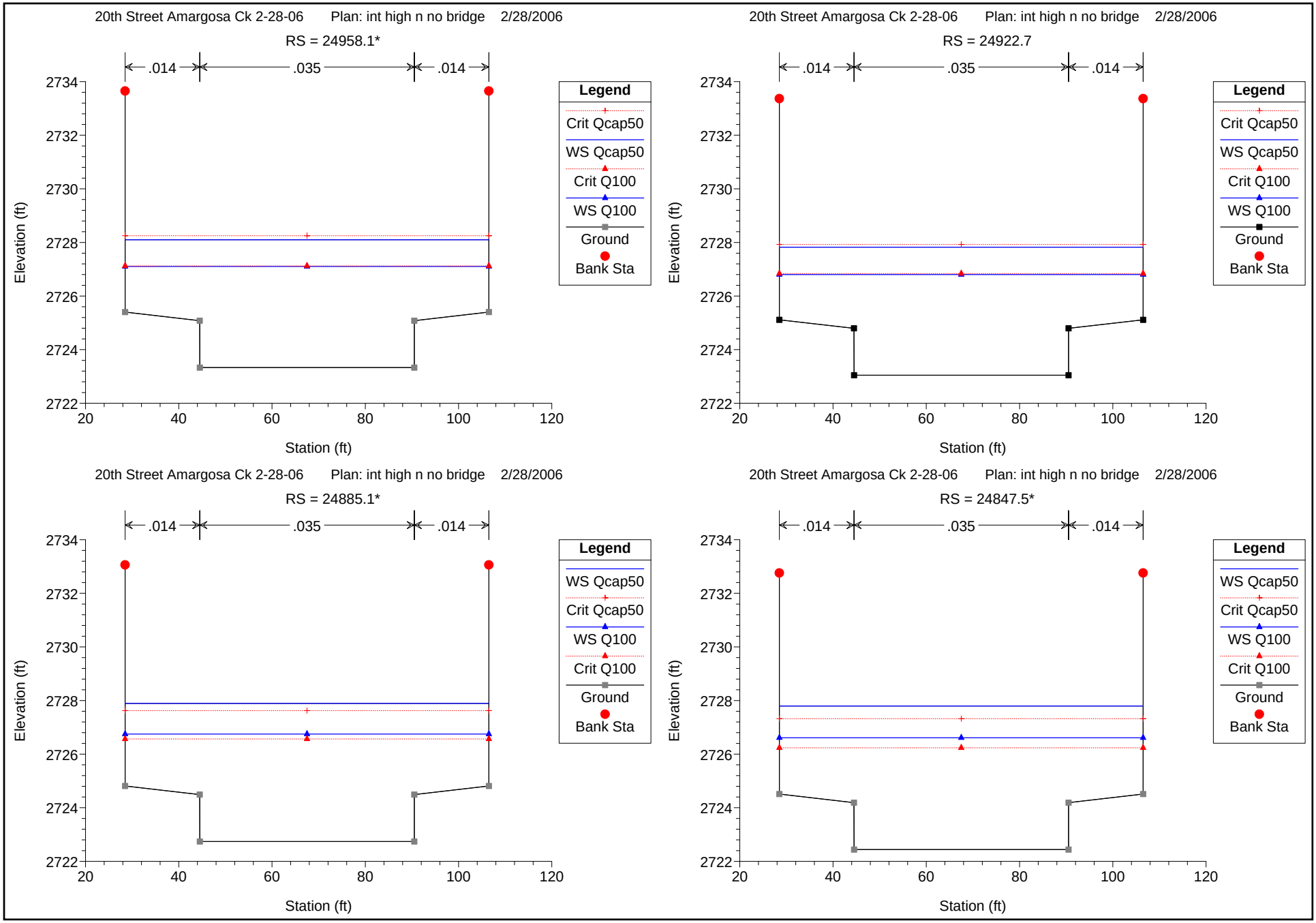
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
WS Q100
Crit Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int high n no bridge 2/28/2006
RS = 25064.5*
20th Street Amargosa Ck 2-28-06 Plan: int high n no bridge 2/28/2006
RS = 25029.0*
20th Street Amargosa Ck 2-28-06 Plan: int high n no bridge 2/28/2006
RS = 24993.6*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.014
.035
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int high n no bridge 2/28/2006
RS = 24922.7
20th Street Amargosa Ck 2-28-06 Plan: int high n no bridge 2/28/2006
RS = 24885.1*
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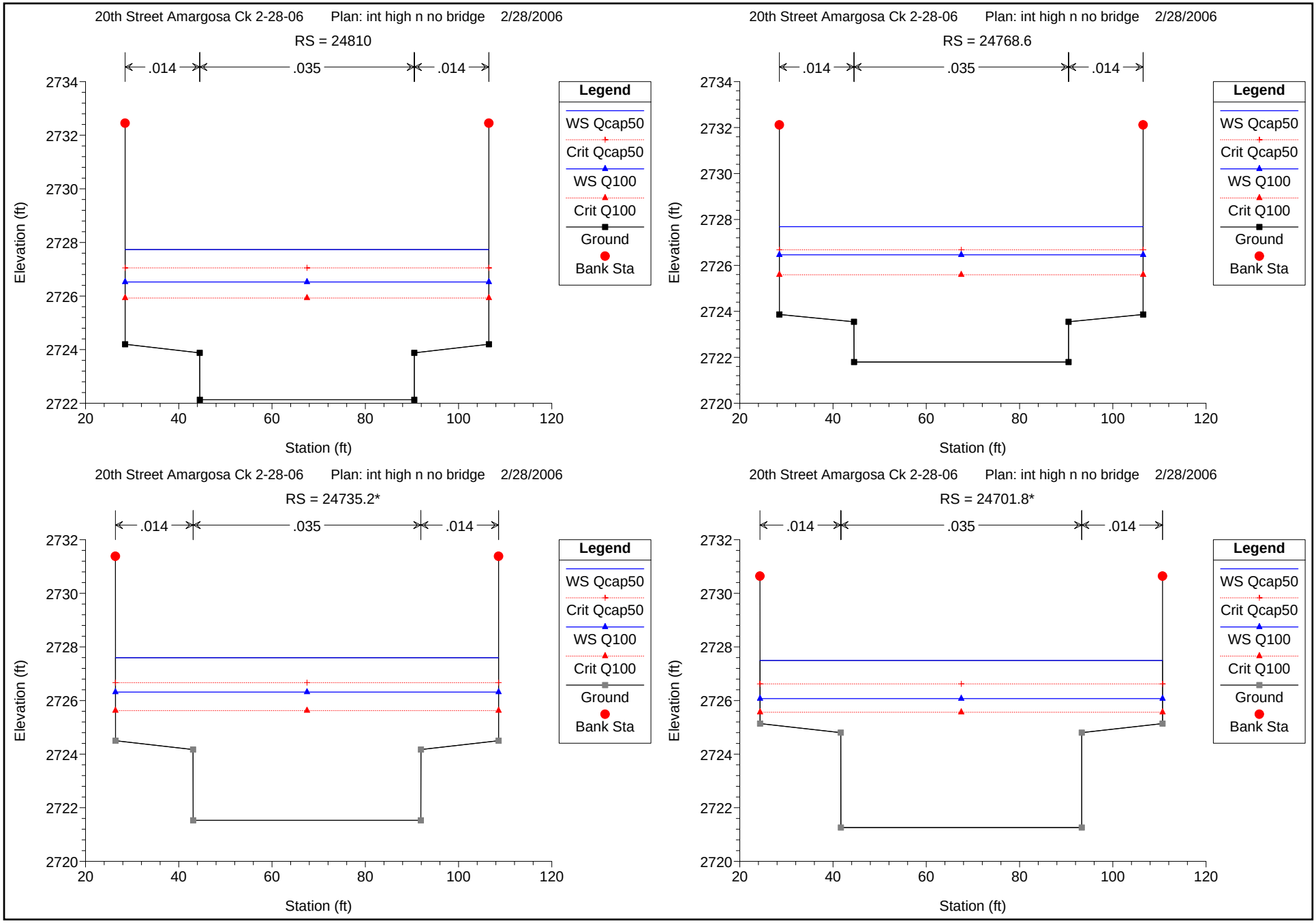
RS = 24847.5*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.035
.014
Elevation (ft)
Station (ft)
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int high n no bridge 2/28/2006
RS = 24768.6
.014
.035
.014
Elevation (ft)
Station (ft)
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int high n no bridge 2/28/2006
RS = 24735.2*
.014
.035
.014
Elevation (ft)
Station (ft)
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int high n no bridge 2/28/2006
RS = 24701.8*
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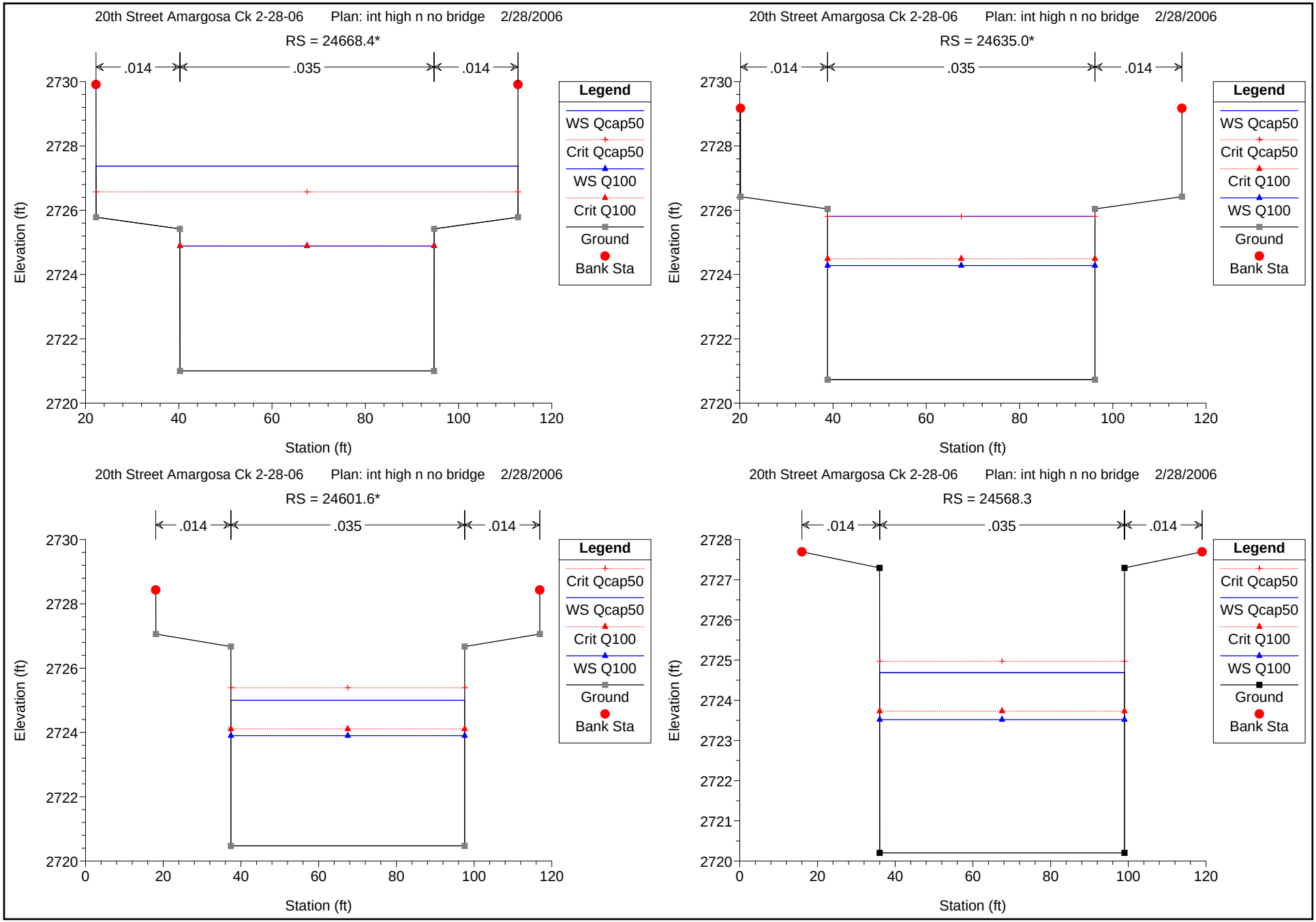
Elevation (ft)
Station (ft)
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Bank Sta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.014
Elevation (ft)
Station (ft)
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Bank Sta
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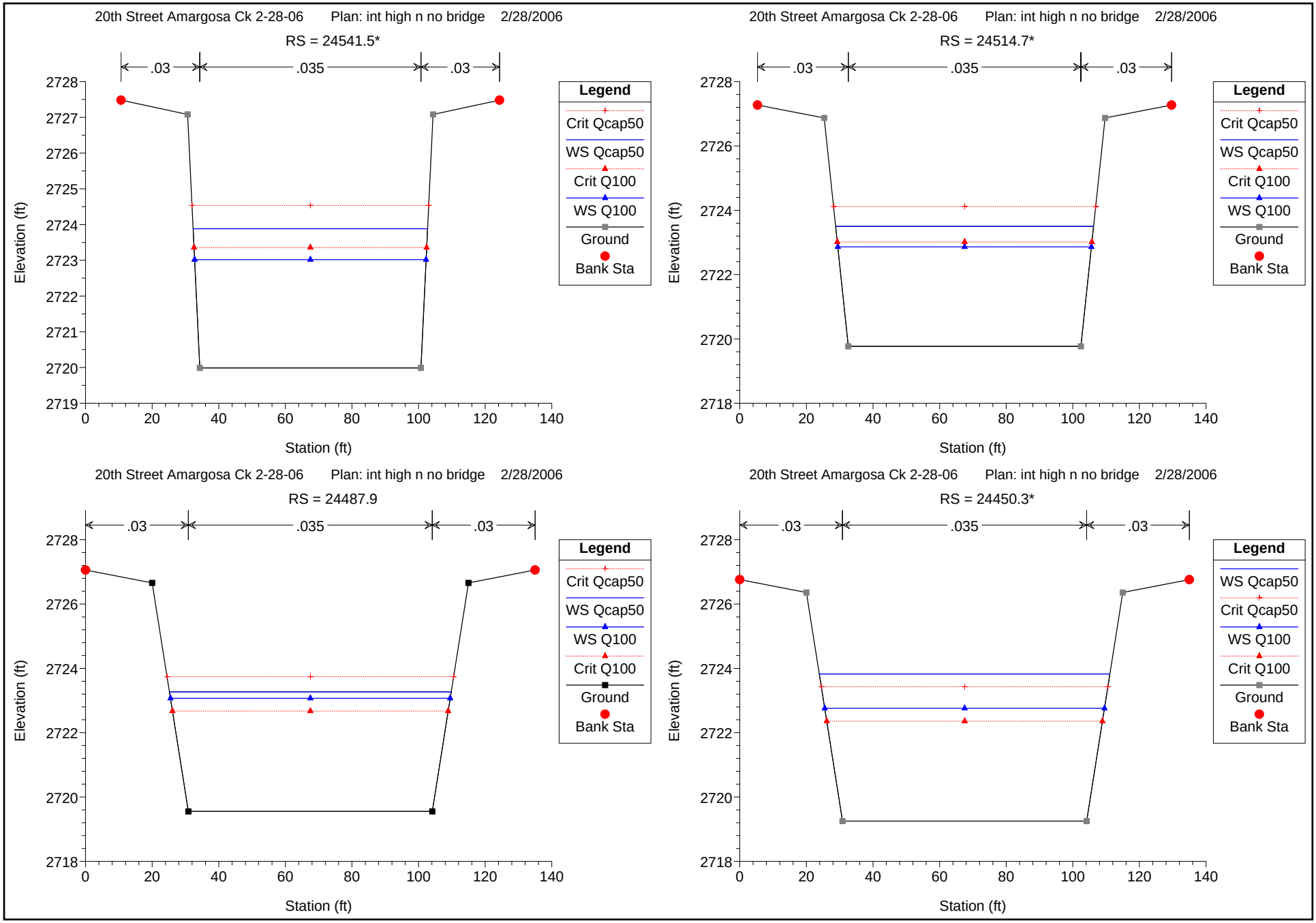
RS = 24635.0*
Elevation (ft)
Station (ft)
20th Street Amargosa Ck 2-28-06 Plan: int high n no bridge 2/28/2006
RS = 24601.6*
Elevation (ft)
Station (ft)
20th Street Amargosa Ck 2-28-06 Plan: int high n no bridge 2/28/2006
RS = 24568.3
Elevation (ft)
Station (ft)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.035
.03
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int high n no bridge 2/28/2006
RS = 24514.7*
.03
.035
.03
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int high n no bridge 2/28/2006
RS = 24487.9
.03
.035
.03
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
WS Q100
Crit Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int high n no bridge 2/28/2006
RS = 24450.3*
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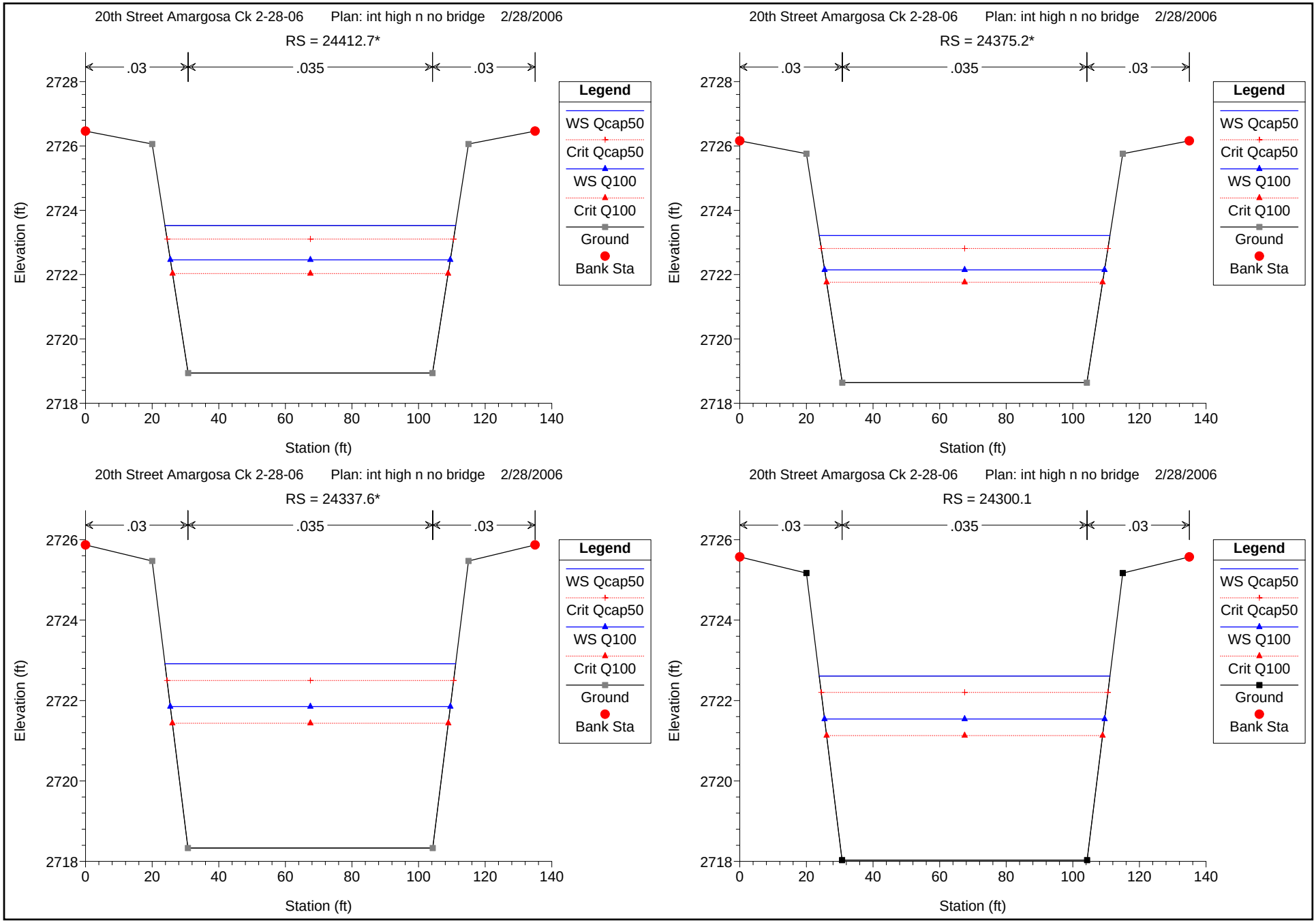
.035
.03
Elevation (ft)
Station (ft)
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Bank Sta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.035
.03
Elevation (ft)
Station (ft)
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int high n no bridge 2/28/2006
RS = 24375.2*
20th Street Amargosa Ck 2-28-06 Plan: int high n no bridge 2/28/2006
RS = 24337.6*
20th Street Amargosa Ck 2-28-06 Plan: int high n no bridge 2/28/2006
RS = 24300.1

HEC-RAS Plan: int hi n River: Amargosa Creek Reach: 1

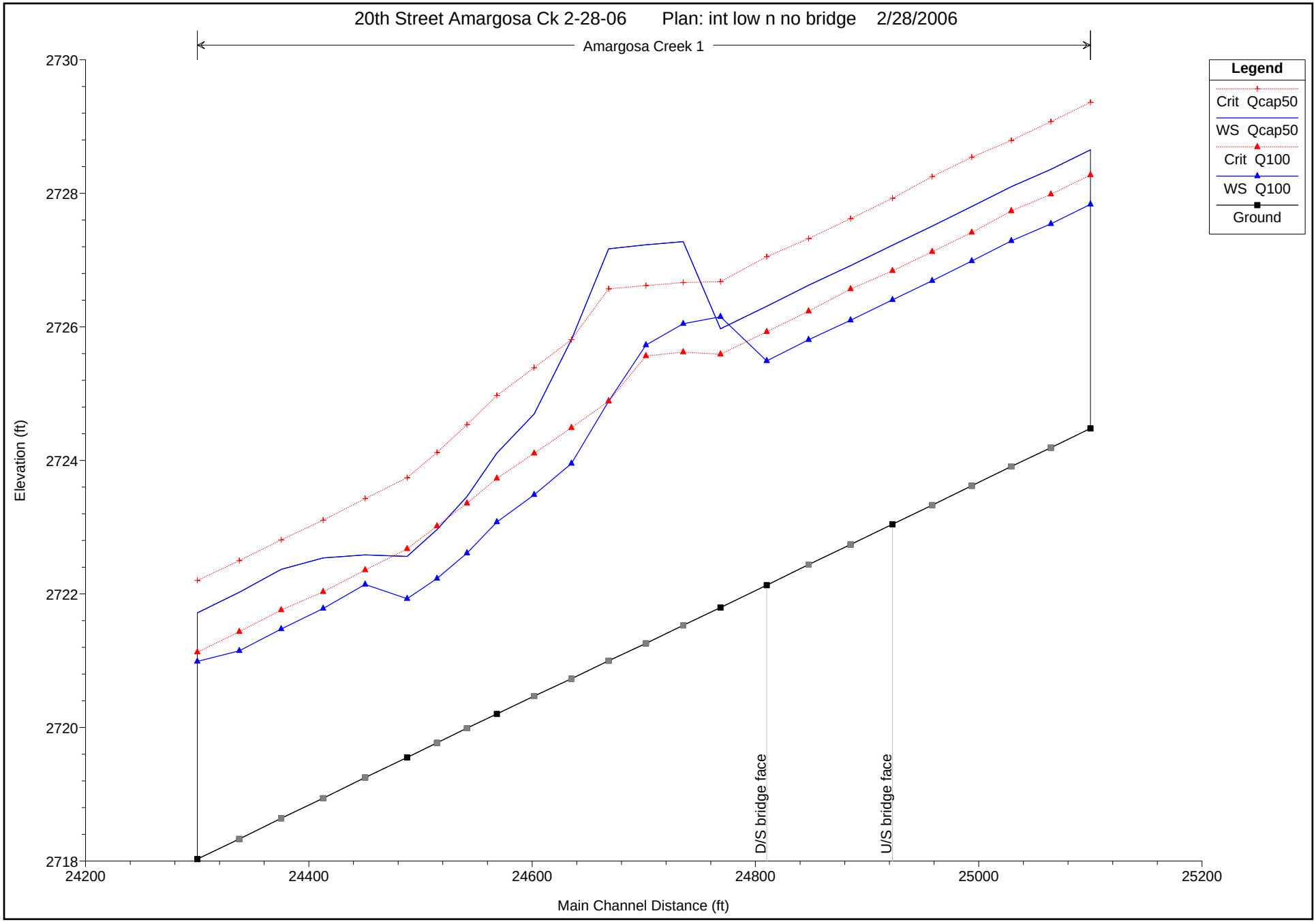
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	25100	Qcap50	3695.00	2724.48	2729.24	2729.36	2731.44	0.008101	11.91	310.15	78.01	1.05
1	25100	Q100	2350.00	2724.48	2728.27	2728.27	2729.83	0.008183	10.01	234.87	78.00	1.02
1	25064.5*	Qcap50	3695.00	2724.19	2728.98	2729.07	2731.15	0.007903	11.82	312.49	78.01	1.04
1	25064.5*	Q100	2350.00	2724.19	2727.98	2727.98	2729.54	0.008205	10.01	234.68	78.00	1.02
1	25029.0*	Qcap50	3695.00	2723.91	2728.70	2728.79	2730.87	0.007903	11.82	312.49	78.01	1.04
1	25029.0*	Q100	2350.00	2723.91	2727.69	2727.74	2729.26	0.008304	10.05	233.82	78.00	1.02
1	24993.6*	Qcap50	3695.00	2723.62	2728.47	2728.54	2730.58	0.007532	11.65	317.11	78.01	1.02
1	24993.6*	Q100	2350.00	2723.62	2727.40	2727.41	2728.97	0.008342	10.06	233.50	78.00	1.03
1	24958.1*	Qcap50	3695.00	2723.33	2728.10	2728.25	2730.29	0.008034	11.88	310.94	78.01	1.05
1	24958.1*	Q100	2350.00	2723.33	2727.10	2727.12	2728.68	0.008396	10.08	233.04	78.00	1.03
1	24922.7	Qcap50	3695.00	2723.04	2727.82	2727.93	2730.01	0.007967	11.85	311.73	78.01	1.04
1	24922.7	Q100	2350.00	2723.04	2726.80	2726.84	2728.40	0.008506	10.12	232.13	78.00	1.03
1	24885.1*	Qcap50	3695.00	2722.74	2727.89	2727.62	2729.72	0.005949	10.84	340.74	78.01	0.91
1	24885.1*	Q100	2350.00	2722.74	2726.75	2726.57	2728.10	0.006517	9.34	251.67	78.00	0.92
1	24847.5*	Qcap50	3695.00	2722.44	2727.80	2727.32	2729.46	0.005125	10.36	356.58	78.01	0.85
1	24847.5*	Q100	2350.00	2722.44	2726.61	2726.23	2727.84	0.005545	8.89	264.31	78.01	0.85
1	24810	Qcap50	3695.00	2722.13	2727.74	2727.05	2729.23	0.004306	9.83	376.03	78.01	0.79
1	24810	Q100	2350.00	2722.13	2726.53	2725.93	2727.61	0.004495	8.34	281.72	78.01	0.77
1	24768.6	Qcap50	3695.00	2721.80	2727.69	2726.68	2729.02	0.003564	9.27	398.41	78.01	0.72
1	24768.6	Q100	2350.00	2721.80	2726.46	2725.59	2727.40	0.003545	7.76	302.82	78.01	0.69
1	24735.2*	Qcap50	3695.00	2721.53	2727.60	2726.67	2728.89	0.003633	9.12	405.04	82.17	0.72
1	24735.2*	Q100	2350.00	2721.53	2726.32	2725.62	2727.27	0.003950	7.84	299.76	82.17	0.72
1	24701.8*	Qcap50	3695.00	2721.26	2727.49	2726.62	2728.76	0.003755	9.02	409.53	86.33	0.73
1	24701.8*	Q100	2350.00	2721.26	2726.07	2725.56	2727.12	0.004899	8.19	286.89	86.32	0.79
1	24668.4*	Qcap50	3695.00	2721.00	2727.37	2726.57	2728.63	0.003966	8.99	410.97	90.50	0.74
1	24668.4*	Q100	2350.00	2721.00	2724.89	2724.89	2726.80	0.011711	11.09	211.85	54.52	0.99
1	24635.0*	Qcap50	3695.00	2720.73	2725.81	2725.81	2728.31	0.010849	12.69	291.20	57.36	0.99
1	24635.0*	Q100	2350.00	2720.73	2724.28	2724.49	2726.35	0.014218	11.54	203.60	57.35	1.08

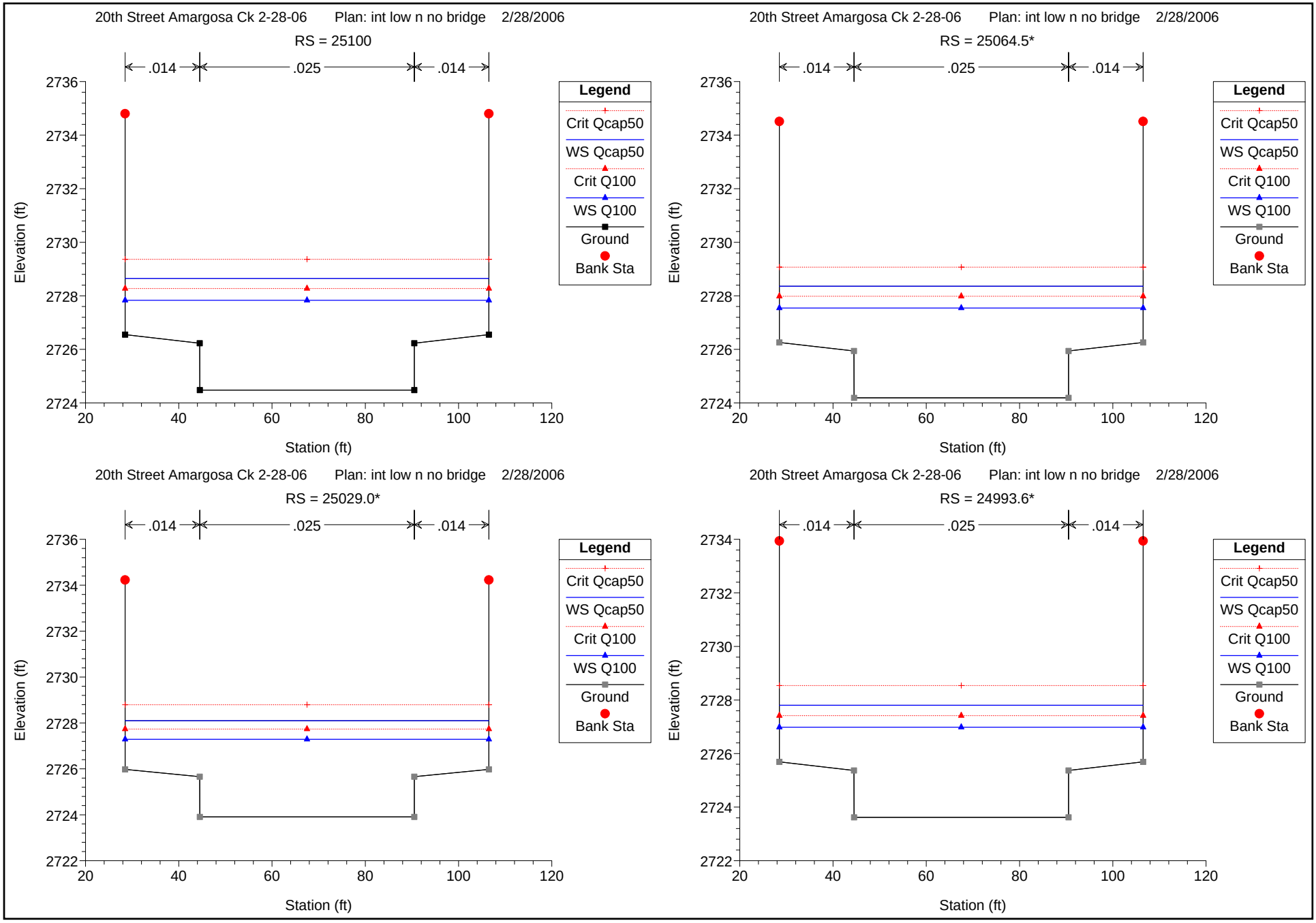
HEC-RAS Plan: int hi n River: Amargosa Creek Reach: 1 (Continued)

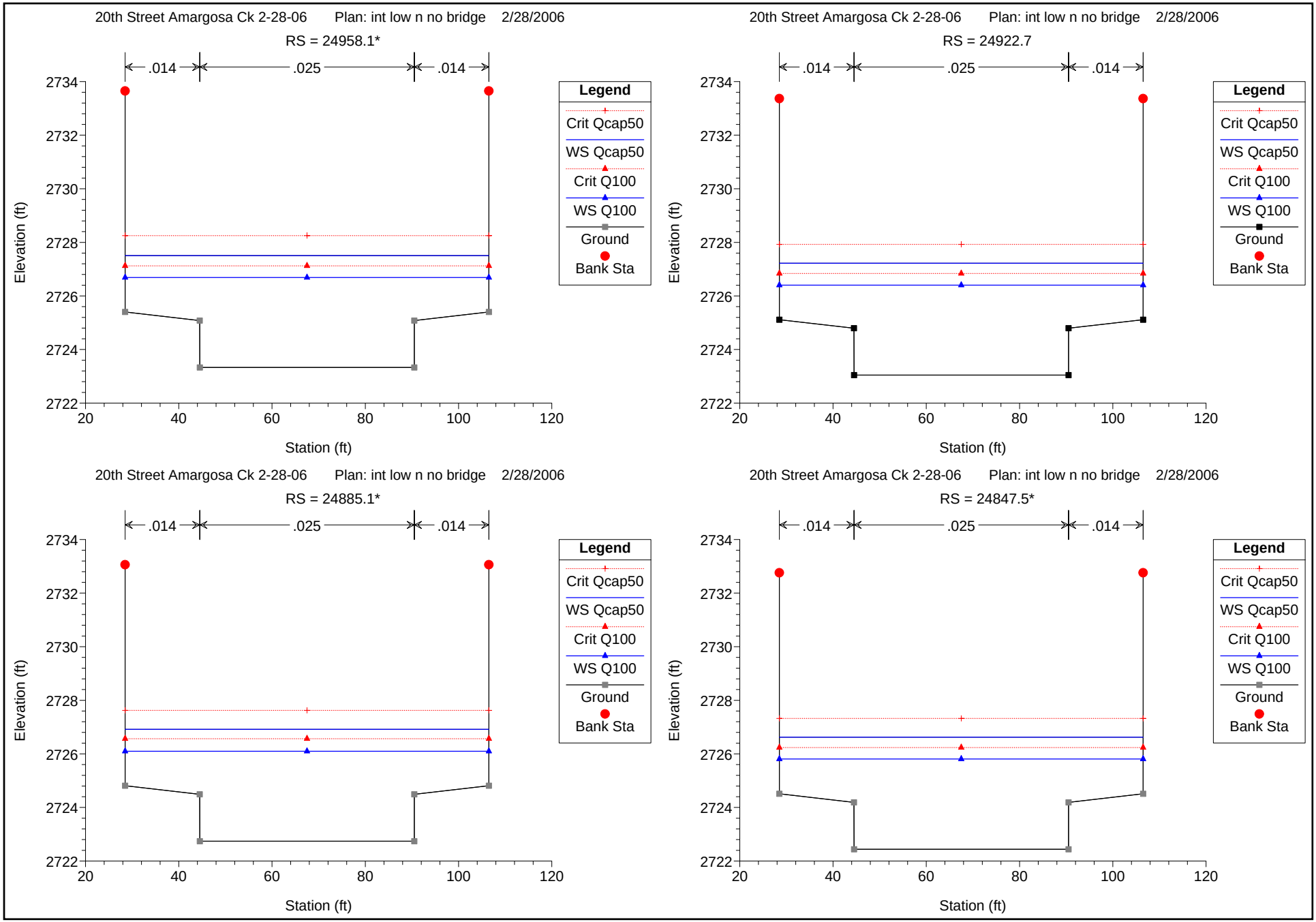
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	24601.6*	Qcap50	3695.00	2720.47	2725.00	2725.39	2727.85	0.014294	13.56	272.57	60.17	1.12
1	24601.6*	Q100	2350.00	2720.47	2723.90	2724.11	2725.91	0.014428	11.38	206.44	60.17	1.08
1	24568.3	Qcap50	3695.00	2720.20	2724.69	2724.97	2727.34	0.013439	13.07	282.61	63.01	1.09
1	24568.3	Q100	2350.00	2720.20	2723.52	2723.73	2725.48	0.014709	11.25	208.89	63.01	1.09
1	24541.5*	Qcap50	3695.00	2719.99	2723.88	2724.54	2726.87	0.019138	13.87	266.31	70.40	1.26
1	24541.5*	Q100	2350.00	2719.99	2723.02	2723.36	2725.04	0.017724	11.41	205.96	69.51	1.17
1	24514.7*	Qcap50	3695.00	2719.77	2723.50	2724.12	2726.31	0.018825	13.45	274.71	77.45	1.26
1	24514.7*	Q100	2350.00	2719.77	2722.86	2723.02	2724.55	0.014276	10.41	225.81	76.15	1.07
1	24487.9	Qcap50	3695.00	2719.55	2723.27	2723.74	2725.73	0.016588	12.59	293.52	84.62	1.19
1	24487.9	Q100	2350.00	2719.55	2723.07	2722.67	2724.19	0.008120	8.50	276.41	84.00	0.83
1	24450.3*	Qcap50	3695.00	2719.25	2723.83	2723.43	2725.40	0.008164	10.06	367.41	87.27	0.86
1	24450.3*	Q100	2350.00	2719.25	2722.76	2722.36	2723.89	0.008169	8.52	275.94	84.01	0.83
1	24412.7*	Qcap50	3695.00	2718.94	2723.53	2723.10	2725.09	0.008091	10.03	368.49	87.30	0.86
1	24412.7*	Q100	2350.00	2718.94	2722.46	2722.03	2723.58	0.008084	8.49	276.89	84.05	0.82
1	24375.2*	Qcap50	3695.00	2718.64	2723.22	2722.81	2724.78	0.008153	10.05	367.67	87.29	0.86
1	24375.2*	Q100	2350.00	2718.64	2722.15	2721.76	2723.27	0.008150	8.51	276.24	84.06	0.83
1	24337.6*	Qcap50	3695.00	2718.33	2722.92	2722.50	2724.48	0.008083	10.02	368.69	87.31	0.86
1	24337.6*	Q100	2350.00	2718.33	2721.85	2721.43	2722.96	0.008058	8.48	277.25	84.10	0.82
1	24300.1	Qcap50	3695.00	2718.03	2722.61	2722.20	2724.17	0.008103	10.03	368.47	87.32	0.86
1	24300.1	Q100	2350.00	2718.03	2721.54	2721.13	2722.66	0.008115	8.49	276.71	84.11	0.83

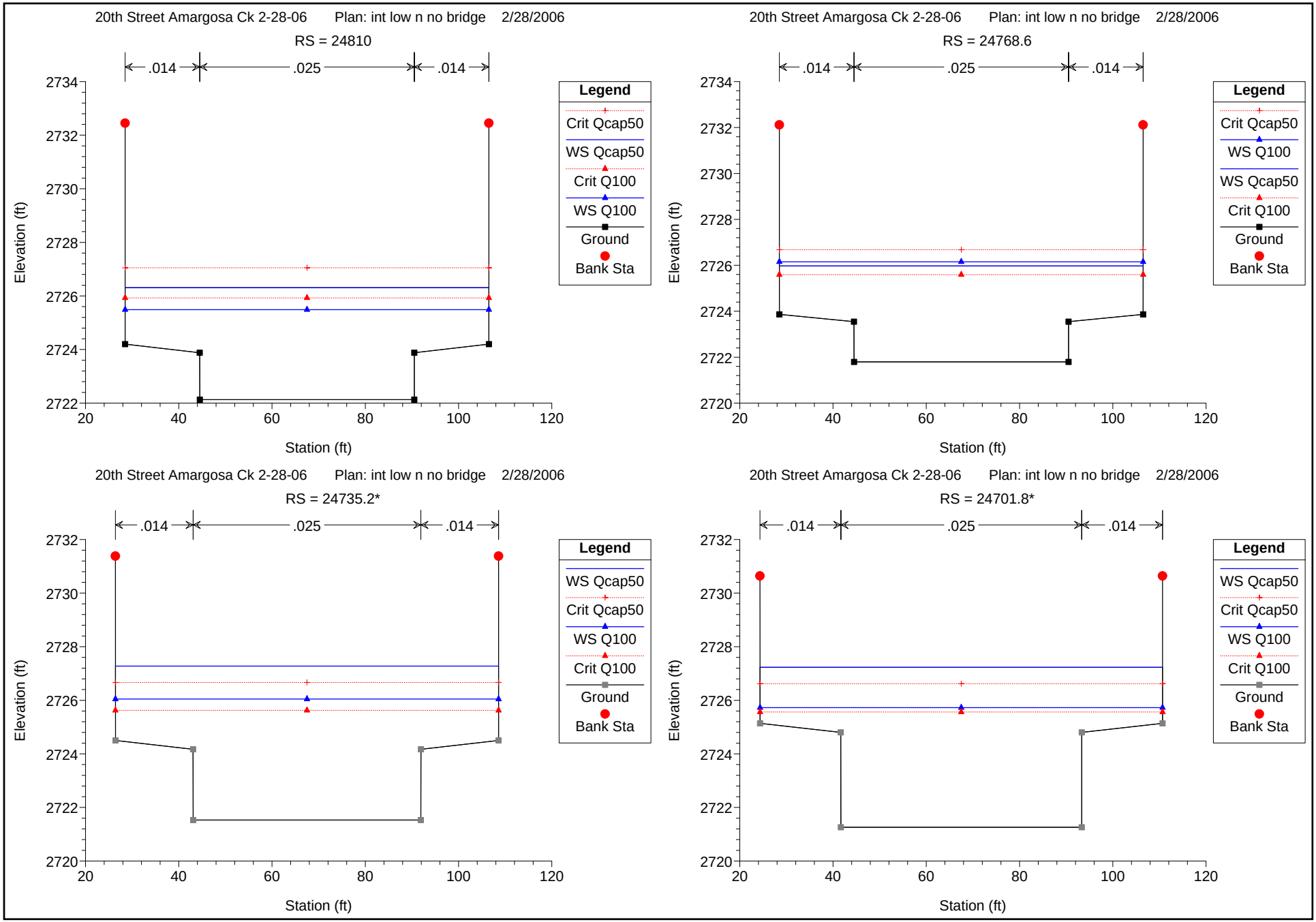
Interim Conditions

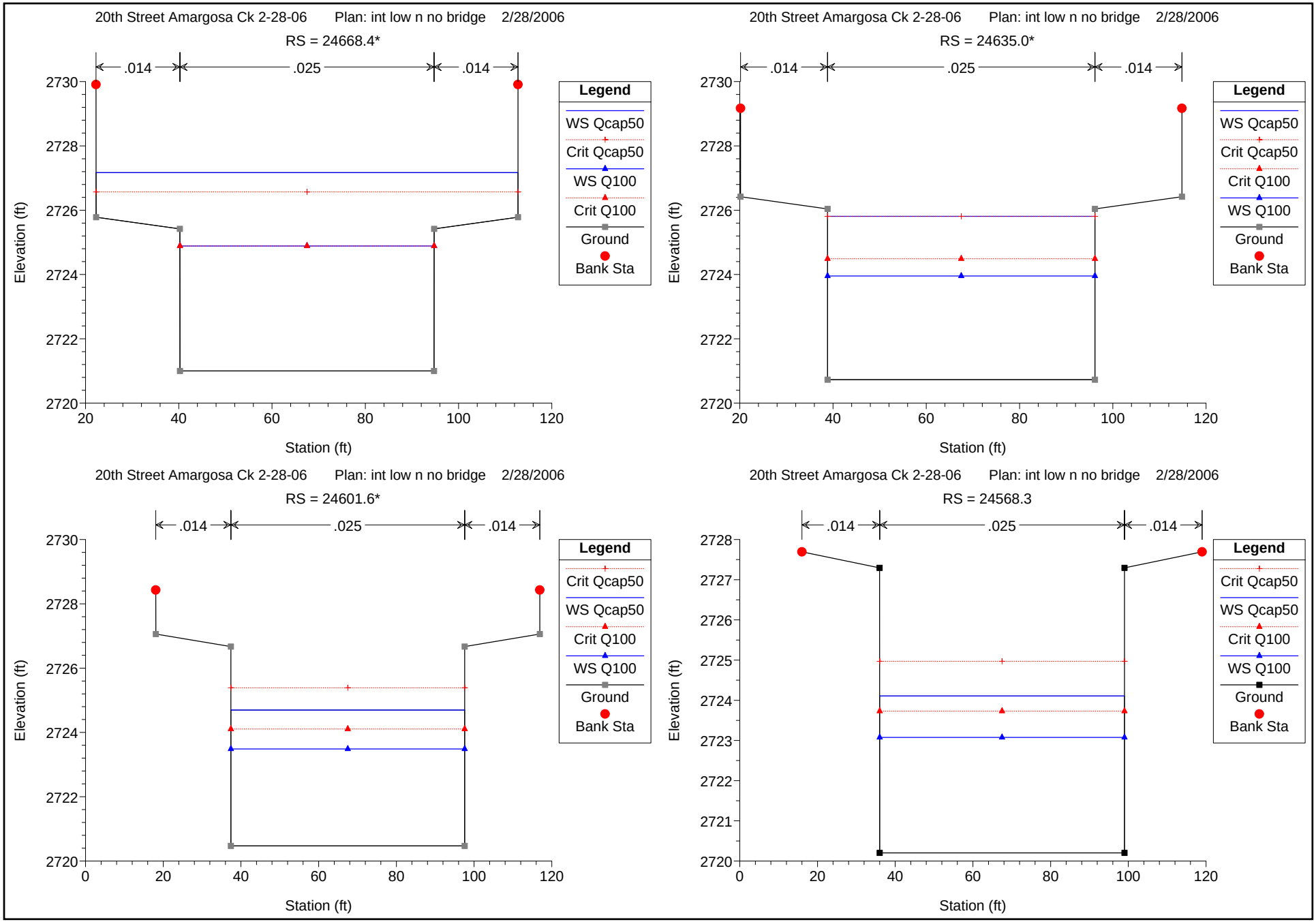
Low Manning's *n*
(for scour evaluation)

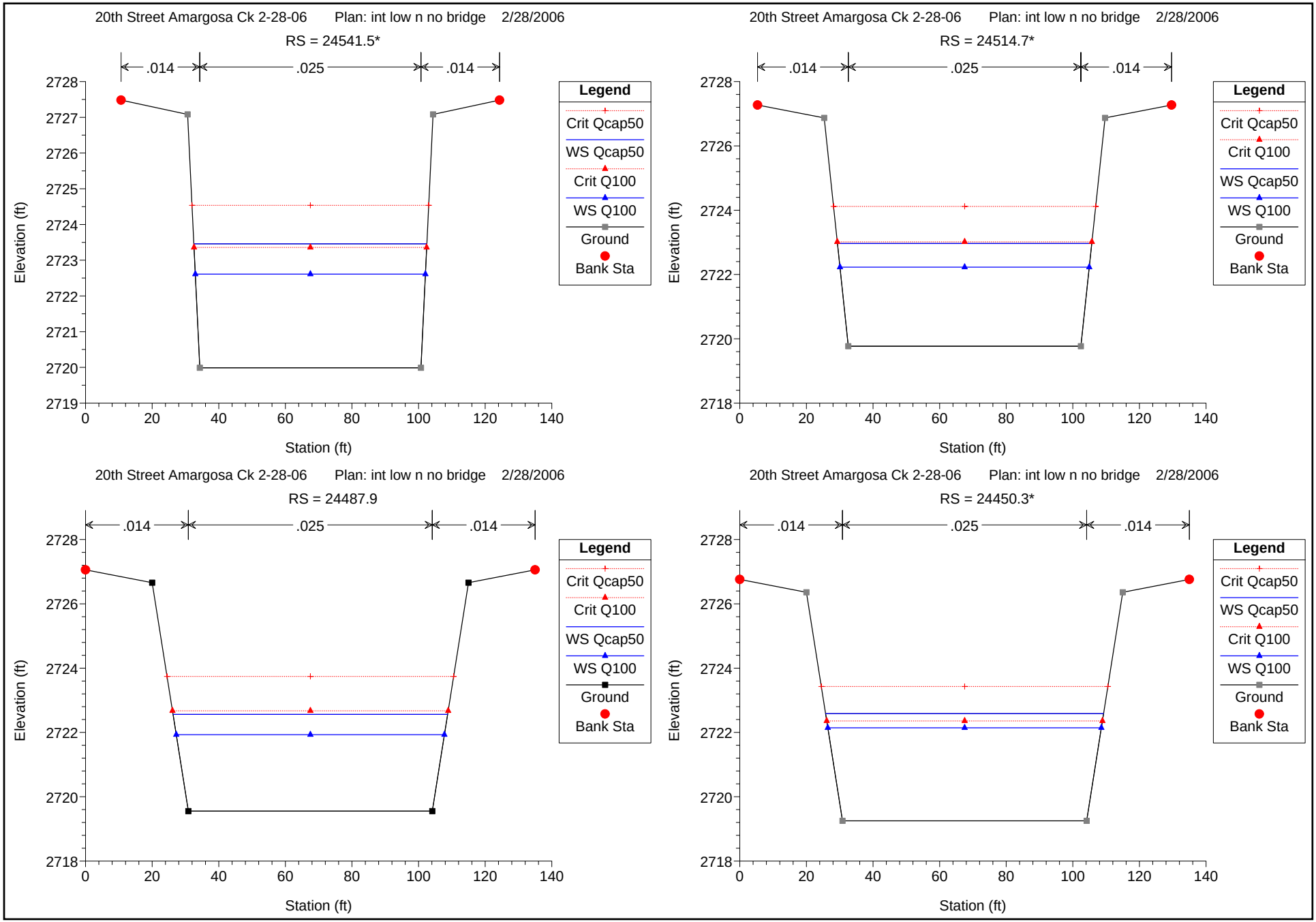

20th Street Amargosa Ck 2-28-06 Plan: int low n no bridge 2/28/2006
Amargosa Creek 1
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Elevation (ft)
2730
2728
2726
2724
2722
2720
2718
24200
24400
24600
24800
25000
25200
Main Channel Distance (ft)
D/S bridge face
U/S bridge face

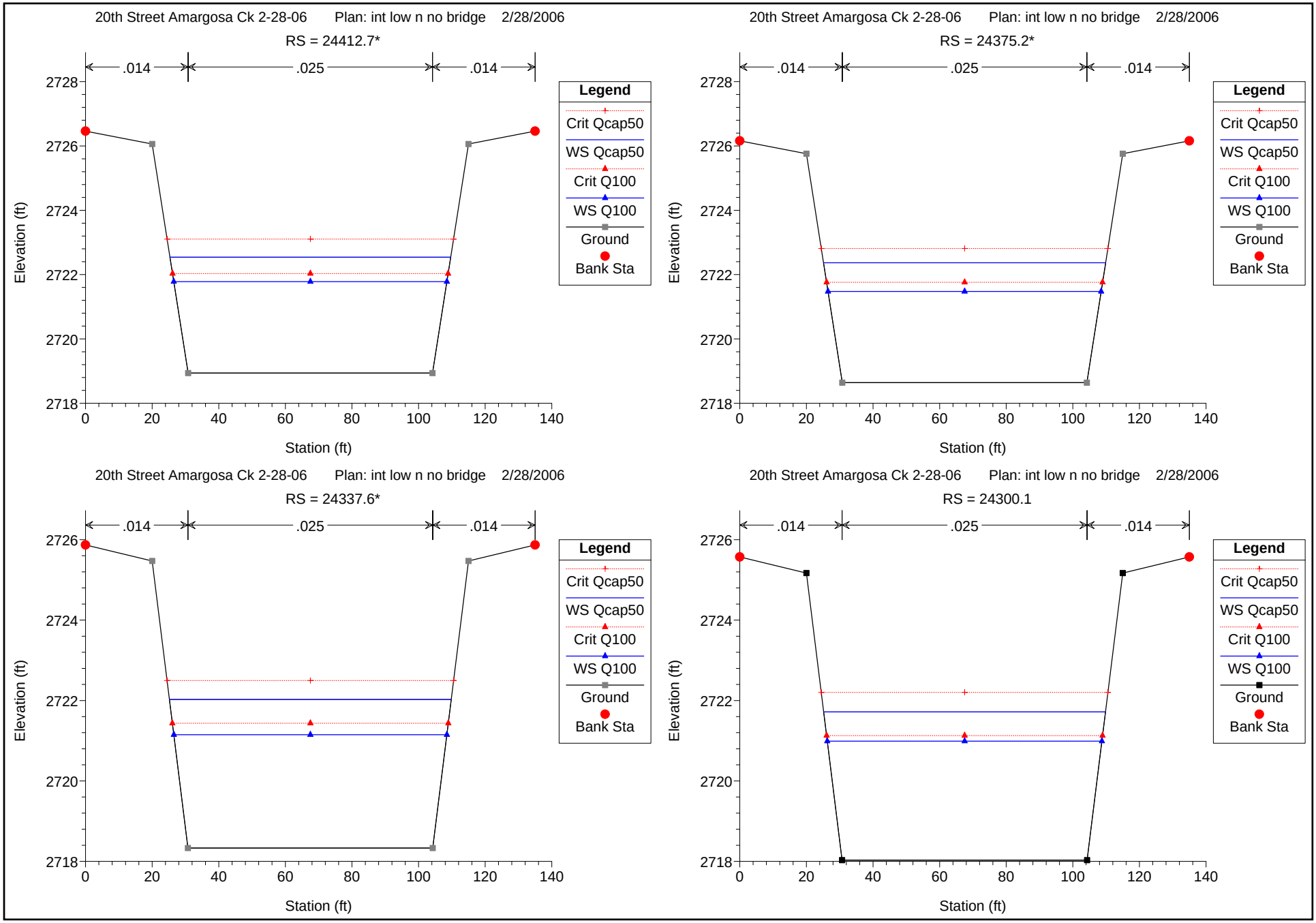

20th Street Amargosa Ck 2-28-06 Plan: int low n no bridge 2/28/2006
RS = 25100
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int low n no bridge 2/28/2006
RS = 25064.5*
20th Street Amargosa Ck 2-28-06 Plan: int low n no bridge 2/28/2006
RS = 25029.0*
20th Street Amargosa Ck 2-28-06 Plan: int low n no bridge 2/28/2006
RS = 24993.6*


20th Street Amargosa Ck 2-28-06 Plan: int low n no bridge 2/28/2006
RS = 24958.1*
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int low n no bridge 2/28/2006
RS = 24922.7
20th Street Amargosa Ck 2-28-06 Plan: int low n no bridge 2/28/2006
RS = 24885.1*
20th Street Amargosa Ck 2-28-06 Plan: int low n no bridge 2/28/2006
RS = 24847.5*


20th Street Amargosa Ck 2-28-06 Plan: int low n no bridge 2/28/2006
RS = 24810
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int low n no bridge 2/28/2006
RS = 24768.6
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Q100
WS Qcap50
Crit Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int low n no bridge 2/28/2006
RS = 24735.2*
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int low n no bridge 2/28/2006
RS = 24701.8*
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Bank Sta


20th Street Amargosa Ck 2-28-06 Plan: int low n no bridge 2/28/2006
RS = 24668.4*
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int low n no bridge 2/28/2006
RS = 24635.0*
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
WS Qcap50
Crit Qcap50
Crit Q100
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int low n no bridge 2/28/2006
RS = 24601.6*
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int low n no bridge 2/28/2006
RS = 24568.3
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta


20th Street Amargosa Ck 2-28-06 Plan: int low n no bridge 2/28/2006
RS = 24541.5*
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int low n no bridge 2/28/2006
RS = 24514.7*
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
Crit Q100
WS Qcap50
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int low n no bridge 2/28/2006
RS = 24487.9
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
Crit Q100
WS Qcap50
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int low n no bridge 2/28/2006
RS = 24450.3*
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta


20th Street Amargosa Ck 2-28-06 Plan: int low n no bridge 2/28/2006
RS = 24412.7*
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int low n no bridge 2/28/2006
RS = 24375.2*
20th Street Amargosa Ck 2-28-06 Plan: int low n no bridge 2/28/2006
RS = 24337.6*
20th Street Amargosa Ck 2-28-06 Plan: int low n no bridge 2/28/2006
RS = 24300.1

HEC-RAS Plan: int lo n River: Amargosa Creek Reach: 1

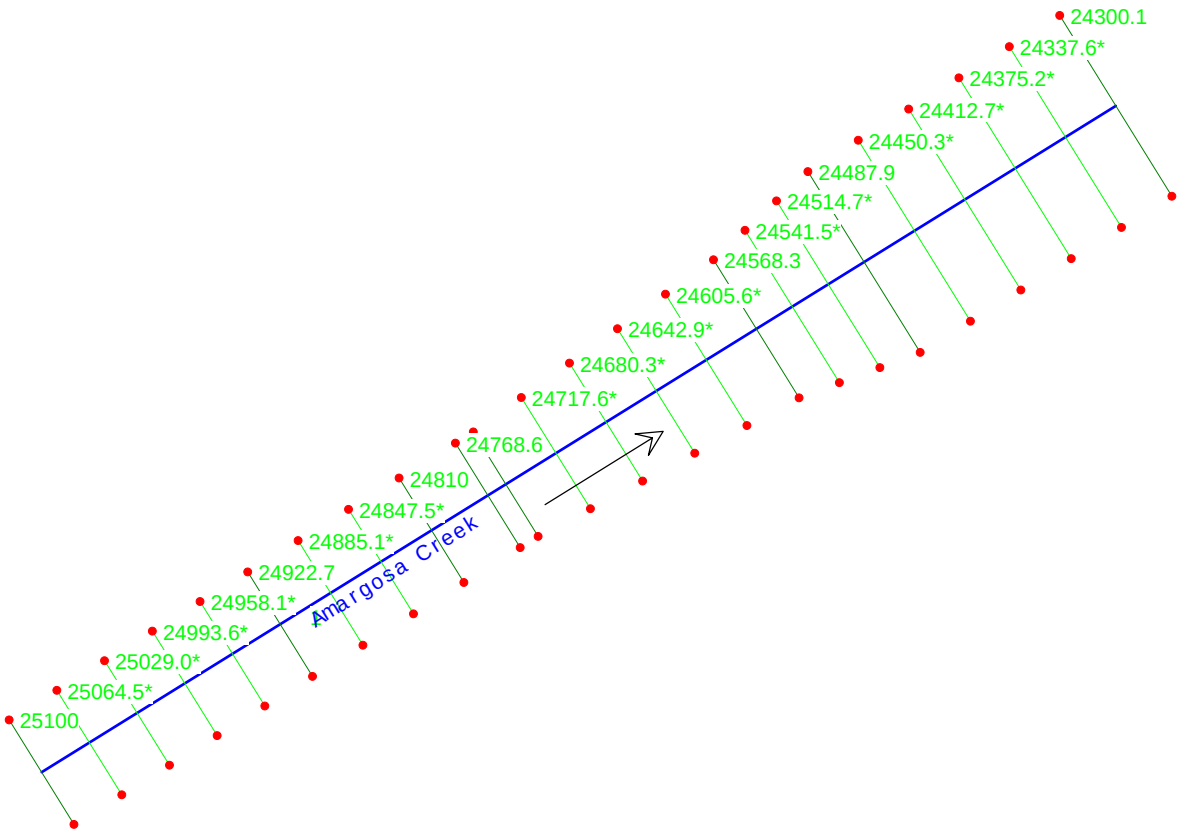
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	25100	Qcap50	3695.00	2724.48	2728.65	2729.36	2731.69	0.008114	13.98	264.29	78.01	1.34
1	25100	Q100	2350.00	2724.48	2727.83	2728.27	2729.97	0.008115	11.72	200.55	78.00	1.29
1	25064.5*	Qcap50	3695.00	2724.19	2728.36	2729.07	2731.40	0.008135	13.99	264.08	78.01	1.34
1	25064.5*	Q100	2350.00	2724.19	2727.54	2727.98	2729.68	0.008128	11.72	200.46	78.00	1.29
1	25029.0*	Qcap50	3695.00	2723.91	2728.10	2728.79	2731.10	0.007982	13.91	265.63	78.01	1.33
1	25029.0*	Q100	2350.00	2723.91	2727.29	2727.74	2729.38	0.007882	11.61	202.34	78.00	1.27
1	24993.6*	Qcap50	3695.00	2723.62	2727.80	2728.54	2730.82	0.008030	13.94	265.13	78.01	1.33
1	24993.6*	Q100	2350.00	2723.62	2726.99	2727.41	2729.10	0.007999	11.67	201.43	78.00	1.28
1	24958.1*	Qcap50	3695.00	2723.33	2727.51	2728.25	2730.53	0.008068	13.96	264.75	78.01	1.34
1	24958.1*	Q100	2350.00	2723.33	2726.69	2727.12	2728.81	0.008064	11.70	200.94	78.00	1.28
1	24922.7	Qcap50	3695.00	2723.04	2727.22	2727.93	2730.25	0.008063	13.95	264.81	78.01	1.33
1	24922.7	Q100	2350.00	2723.04	2726.41	2726.84	2728.53	0.008052	11.69	201.03	78.00	1.28
1	24885.1*	Qcap50	3695.00	2722.74	2726.92	2727.62	2729.94	0.008072	13.96	264.71	78.01	1.34
1	24885.1*	Q100	2350.00	2722.74	2726.10	2726.57	2728.22	0.008070	11.70	200.89	78.00	1.28
1	24847.5*	Qcap50	3695.00	2722.44	2726.62	2727.32	2729.64	0.008023	13.93	265.21	78.01	1.33
1	24847.5*	Q100	2350.00	2722.44	2725.81	2726.23	2727.92	0.007985	11.66	201.54	78.00	1.28
1	24810	Qcap50	3695.00	2722.13	2726.31	2727.05	2729.33	0.008076	13.96	264.68	78.01	1.34
1	24810	Q100	2350.00	2722.13	2725.49	2725.93	2727.62	0.008077	11.70	200.84	78.00	1.29
1	24768.6	Qcap50	3695.00	2721.80	2725.97	2726.68	2729.00	0.008084	13.96	264.60	78.01	1.34
1	24768.6	Q100	2350.00	2721.80	2726.15	2725.59	2727.26	0.002760	8.43	278.67	78.01	0.79
1	24735.2*	Qcap50	3695.00	2721.53	2727.28	2726.67	2728.76	0.002694	9.76	378.74	82.17	0.80
1	24735.2*	Q100	2350.00	2721.53	2726.05	2725.62	2727.16	0.003003	8.46	277.70	82.16	0.81
1	24701.8*	Qcap50	3695.00	2721.26	2727.23	2726.62	2728.65	0.002691	9.55	386.72	86.33	0.80
1	24701.8*	Q100	2350.00	2721.26	2725.73	2725.56	2727.03	0.004147	9.14	257.05	86.32	0.93
1	24668.4*	Qcap50	3695.00	2721.00	2727.17	2726.57	2728.54	0.002729	9.41	392.69	90.49	0.80
1	24668.4*	Q100	2350.00	2721.00	2724.89	2724.89	2726.80	0.006158	11.09	211.85	54.52	0.99

HEC-RAS Plan: int lo n River: Amargosa Creek Reach: 1 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	24635.0*	Qcap50	3695.00	2720.73	2725.81	2725.81	2728.31	0.005744	12.69	291.20	57.36	0.99
1	24635.0*	Q100	2350.00	2720.73	2723.95	2724.49	2726.46	0.010218	12.71	184.83	57.35	1.25
1	24601.6*	Qcap50	3695.00	2720.47	2724.70	2725.39	2727.98	0.009444	14.53	254.24	60.17	1.25
1	24601.6*	Q100	2350.00	2720.47	2723.49	2724.11	2726.09	0.011519	12.95	181.41	60.17	1.31
1	24568.3	Qcap50	3695.00	2720.20	2724.11	2724.97	2727.61	0.011101	15.02	246.07	63.01	1.34
1	24568.3	Q100	2350.00	2720.20	2723.08	2723.73	2725.69	0.012272	12.98	181.04	63.01	1.35
1	24541.5*	Qcap50	3695.00	2719.99	2723.46	2724.54	2727.25	0.013553	15.63	236.45	69.96	1.50
1	24541.5*	Q100	2350.00	2719.99	2722.61	2723.36	2725.33	0.014019	13.23	177.58	69.09	1.45
1	24514.7*	Qcap50	3695.00	2719.77	2722.96	2724.12	2726.85	0.015231	15.83	233.44	76.35	1.60
1	24514.7*	Q100	2350.00	2719.77	2722.23	2723.02	2724.94	0.014986	13.21	177.94	74.85	1.51
1	24487.9	Qcap50	3695.00	2719.55	2722.56	2723.74	2726.43	0.016210	15.77	234.25	82.45	1.65
1	24487.9	Q100	2350.00	2719.55	2721.93	2722.67	2724.50	0.014762	12.86	182.71	80.51	1.50
1	24450.3*	Qcap50	3695.00	2719.25	2722.59	2723.43	2725.69	0.011348	14.13	261.45	83.48	1.41
1	24450.3*	Q100	2350.00	2719.25	2722.14	2722.36	2723.84	0.007512	10.46	224.75	82.13	1.11
1	24412.7*	Qcap50	3695.00	2718.94	2722.54	2723.10	2725.17	0.008703	13.02	283.76	84.30	1.25
1	24412.7*	Q100	2350.00	2718.94	2721.78	2722.03	2723.54	0.007972	10.65	220.75	82.00	1.14
1	24375.2*	Qcap50	3695.00	2718.64	2722.37	2722.81	2724.81	0.007693	12.53	294.85	84.73	1.18
1	24375.2*	Q100	2350.00	2718.64	2721.48	2721.76	2723.24	0.008023	10.66	220.39	82.03	1.15
1	24337.6*	Qcap50	3695.00	2718.33	2722.03	2722.50	2724.51	0.007931	12.65	292.14	84.63	1.20
1	24337.6*	Q100	2350.00	2718.33	2721.15	2721.43	2722.94	0.008180	10.72	219.13	81.99	1.16
1	24300.1	Qcap50	3695.00	2718.03	2721.72	2722.20	2724.21	0.007986	12.67	291.62	84.64	1.20
1	24300.1	Q100	2350.00	2718.03	2720.99	2721.13	2722.60	0.006901	10.18	230.94	82.46	1.07

Ultimate Conditions

High Manning's *n*
(for freeboard evaluation)


24300.1
24337.6*
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24568.3
24605.6*
24642.9*
24680.3*
24717.6*
24768.6
24810
24847.5*
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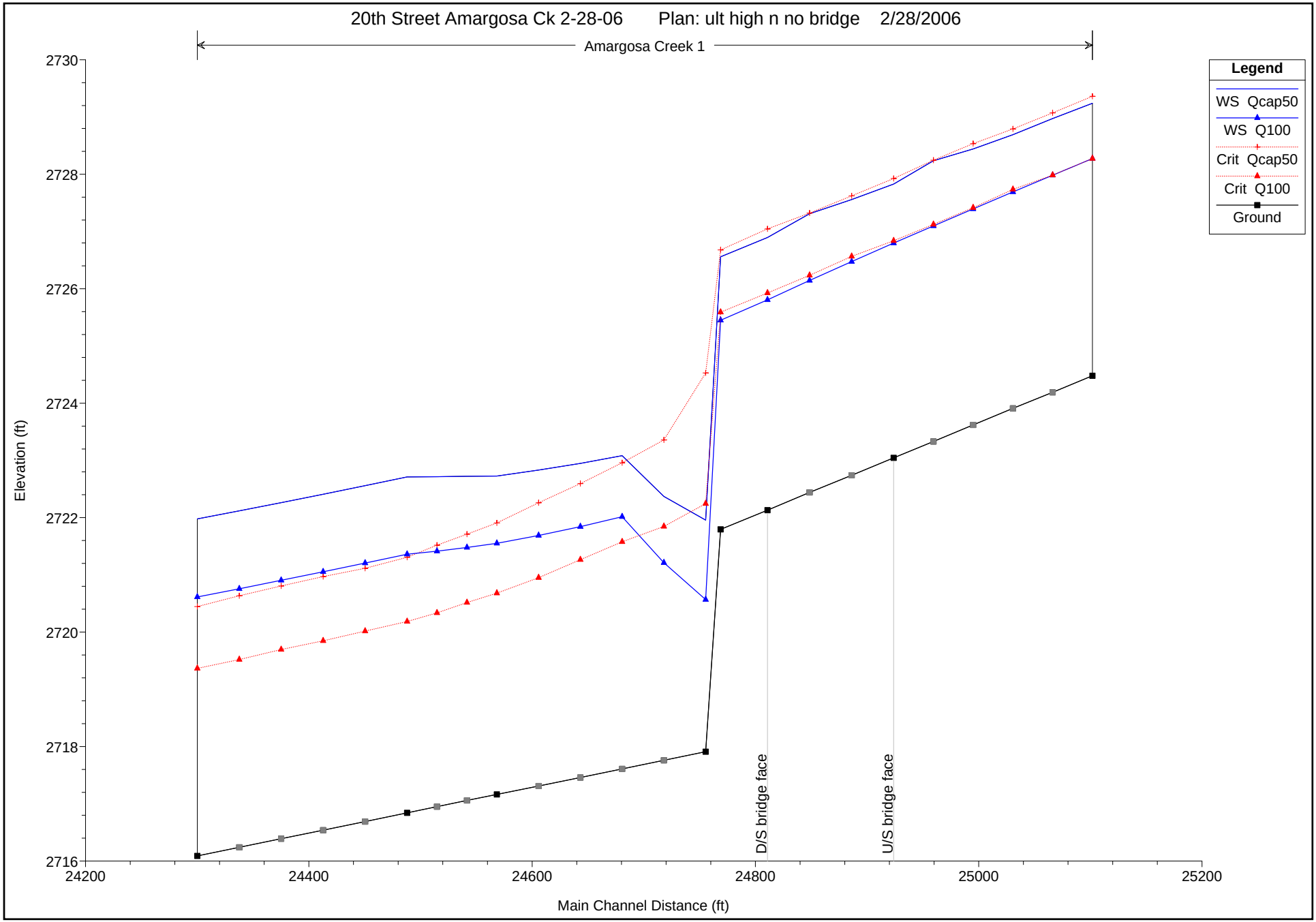
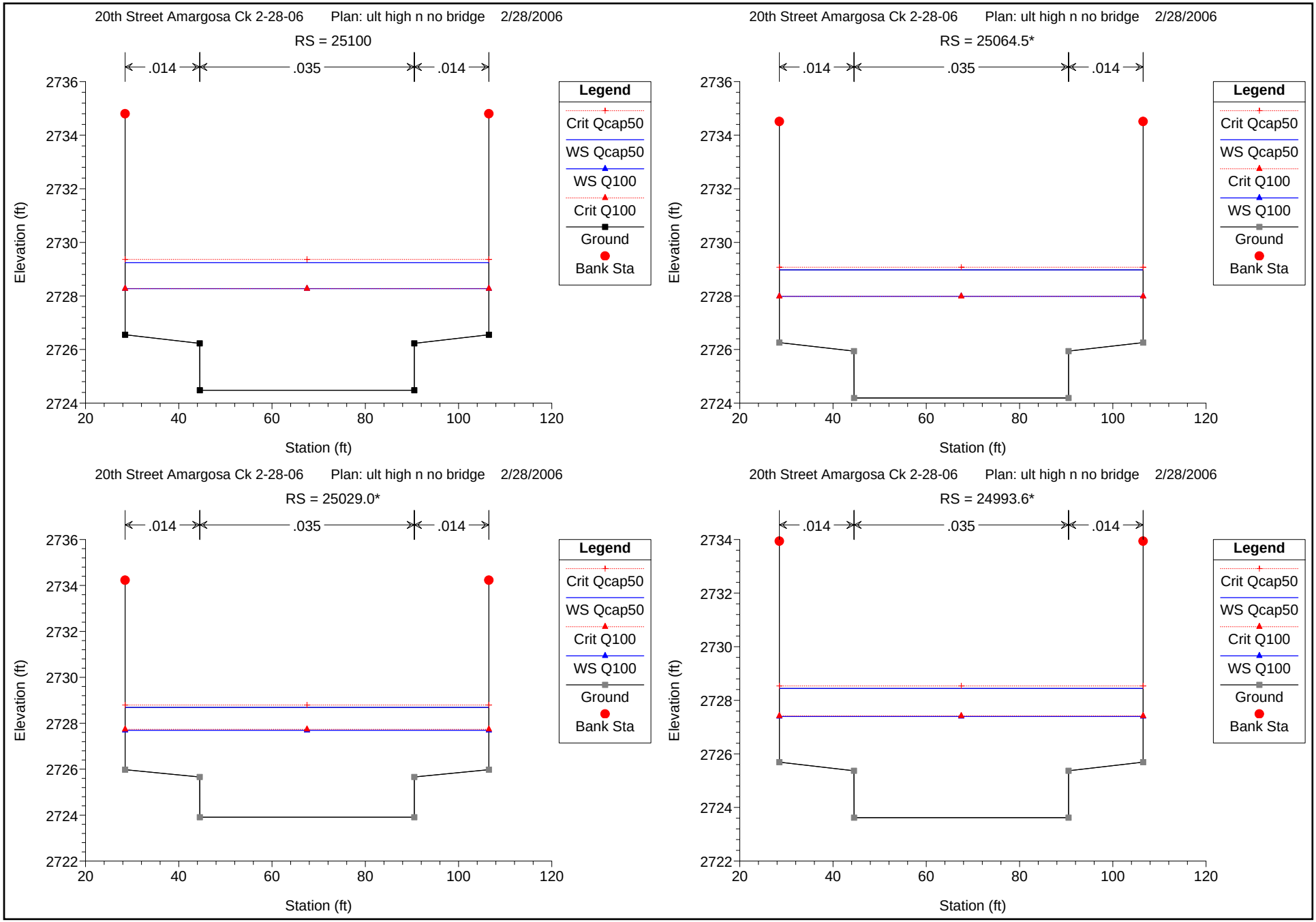
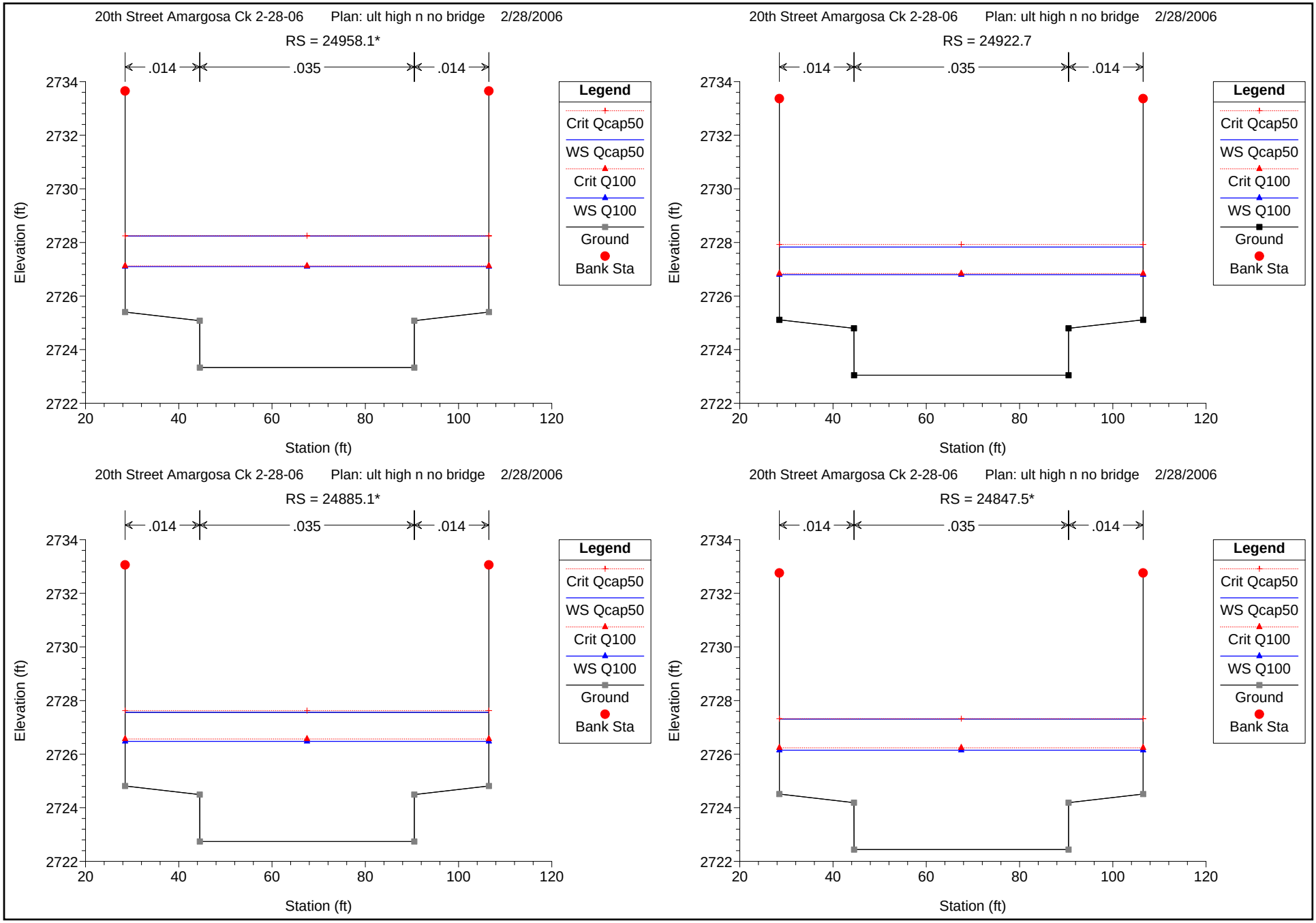
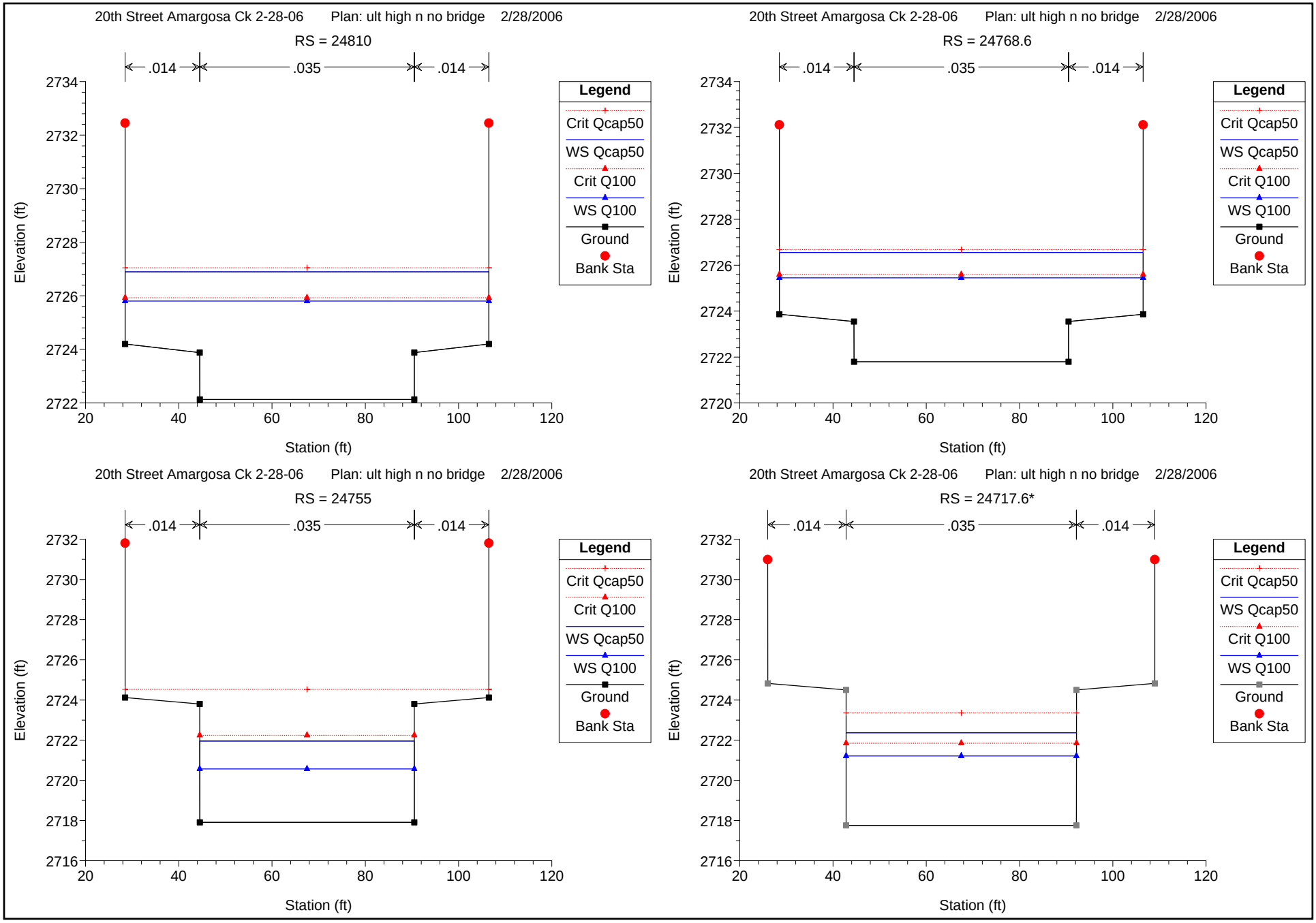
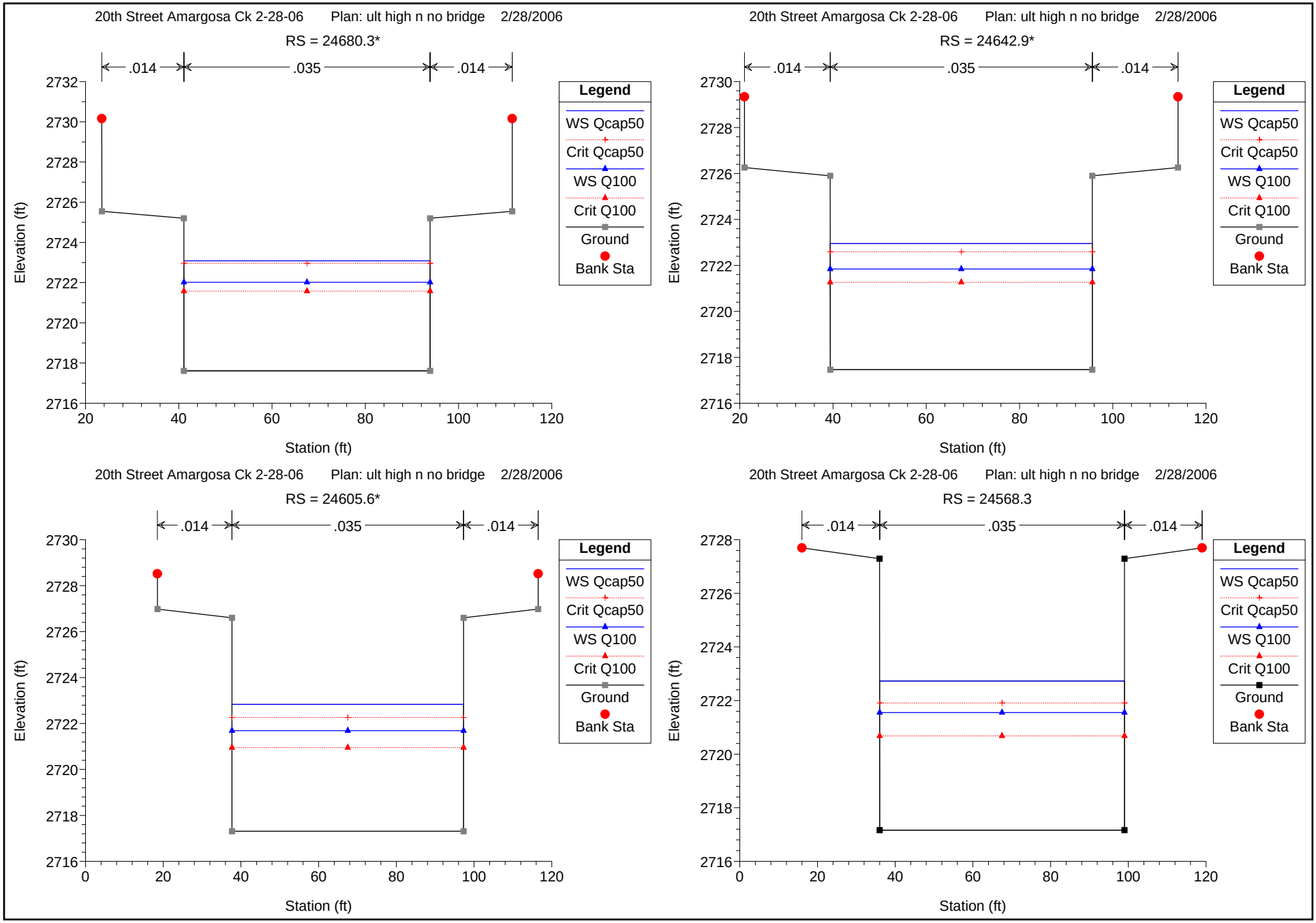
25064.5*
25100
Amargosa Creek

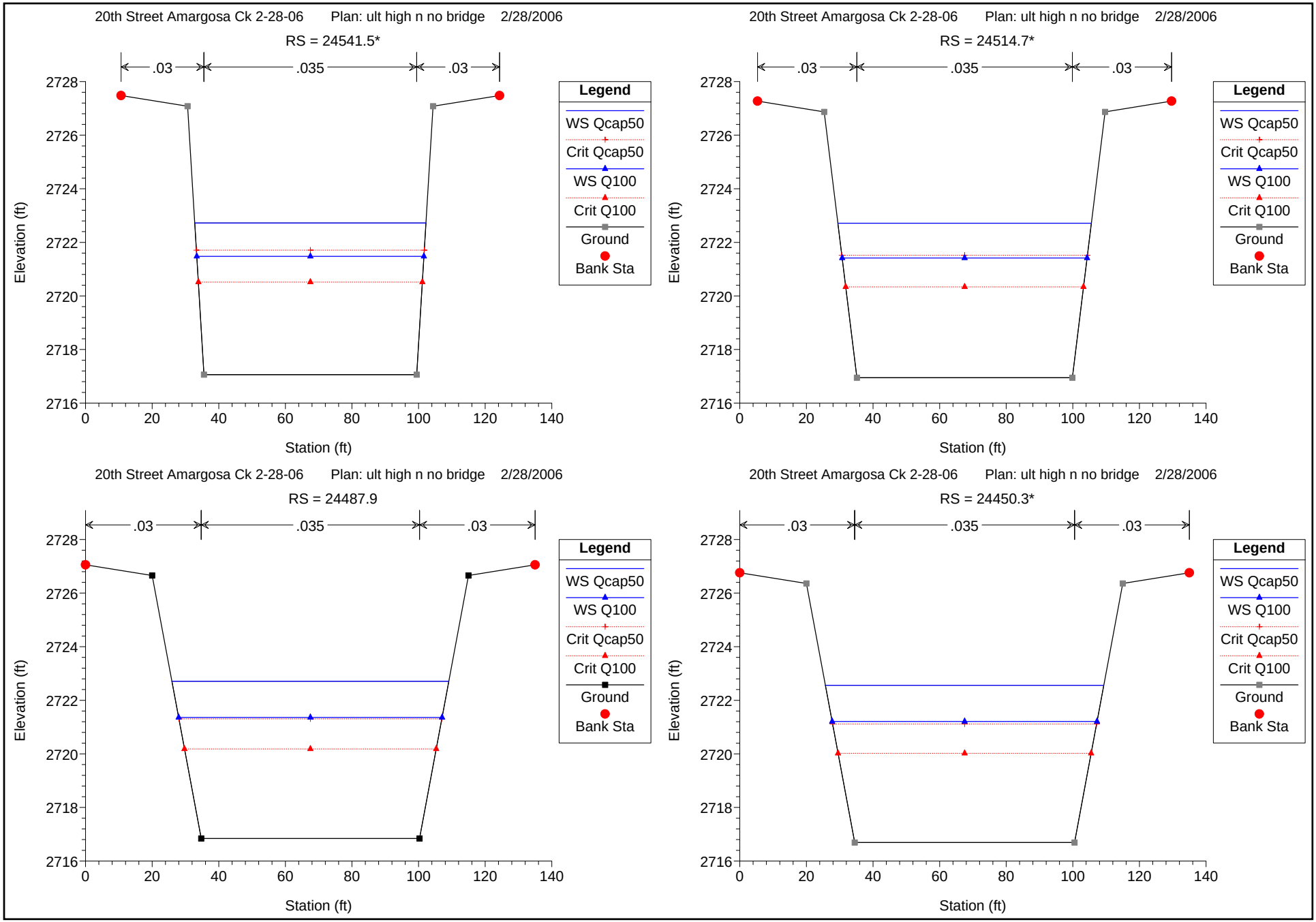

20th Street Amargosa Ck 2-28-06 Plan: ult high n no bridge 2/28/2006
Amargosa Creek 1
Legend
WS Qcap50
WS Q100
Crit Qcap50
Crit Q100
Ground
Elevation (ft)
2730
2728
2726
2724
2722
2720
2718
2716
24200
24400
24600
24800
25000
25200
Main Channel Distance (ft)
D/S bridge face
U/S bridge face

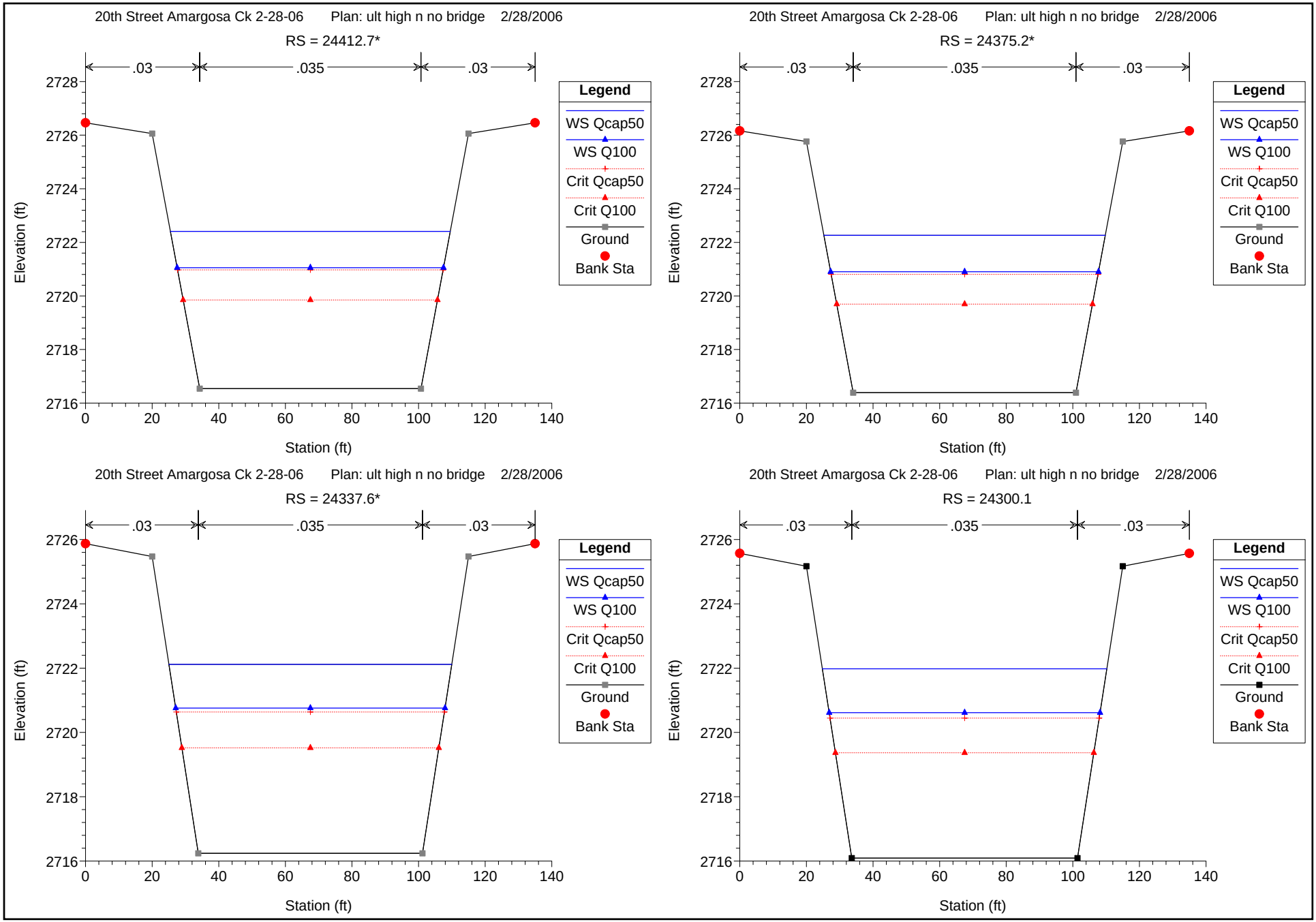

20th Street Amargosa Ck 2-28-06 Plan: ult high n no bridge 2/28/2006
RS = 25100
.014
.035
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
WS Q100
Crit Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult high n no bridge 2/28/2006
RS = 25064.5*
20th Street Amargosa Ck 2-28-06 Plan: ult high n no bridge 2/28/2006
RS = 25029.0*
20th Street Amargosa Ck 2-28-06 Plan: ult high n no bridge 2/28/2006
RS = 24993.6*


20th Street Amargosa Ck 2-28-06 Plan: ult high n no bridge 2/28/2006
RS = 24958.1*
.014
.035
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult high n no bridge 2/28/2006
RS = 24922.7
20th Street Amargosa Ck 2-28-06 Plan: ult high n no bridge 2/28/2006
RS = 24885.1*
20th Street Amargosa Ck 2-28-06 Plan: ult high n no bridge 2/28/2006
RS = 24847.5*


20th Street Amargosa Ck 2-28-06 Plan: ult high n no bridge 2/28/2006
RS = 24810
.014
.035
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult high n no bridge 2/28/2006
RS = 24768.6
20th Street Amargosa Ck 2-28-06 Plan: ult high n no bridge 2/28/2006
RS = 24755
20th Street Amargosa Ck 2-28-06 Plan: ult high n no bridge 2/28/2006
RS = 24717.6*


20th Street Amargosa Ck 2-28-06 Plan: ult high n no bridge 2/28/2006
RS = 24680.3*
.014
.035
.014
Elevation (ft)
Station (ft)
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult high n no bridge 2/28/2006
RS = 24642.9*
.014
.035
.014
Elevation (ft)
Station (ft)
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult high n no bridge 2/28/2006
RS = 24605.6*
.014
.035
.014
Elevation (ft)
Station (ft)
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult high n no bridge 2/28/2006
RS = 24568.3
.014
.035
.014
Elevation (ft)
Station (ft)
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Bank Sta


20th Street Amargosa Ck 2-28-06 Plan: ult high n no bridge 2/28/2006
RS = 24541.5*
.03
.035
.03
Elevation (ft)
Station (ft)
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult high n no bridge 2/28/2006
RS = 24514.7*
.03
.035
.03
Elevation (ft)
Station (ft)
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult high n no bridge 2/28/2006
RS = 24487.9
.03
.035
.03
Elevation (ft)
Station (ft)
Legend
WS Qcap50
WS Q100
Crit Qcap50
Crit Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult high n no bridge 2/28/2006
RS = 24450.3*
.03
.035
.03
Elevation (ft)
Station (ft)
Legend
WS Qcap50
WS Q100
Crit Qcap50
Crit Q100
Ground
Bank Sta


20th Street Amargosa Ck 2-28-06 Plan: ult high n no bridge 2/28/2006
RS = 24412.7*
.03
.035
.03
Elevation (ft)
Station (ft)
Legend
WS Qcap50
WS Q100
Crit Qcap50
Crit Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult high n no bridge 2/28/2006
RS = 24375.2*
20th Street Amargosa Ck 2-28-06 Plan: ult high n no bridge 2/28/2006
RS = 24337.6*
20th Street Amargosa Ck 2-28-06 Plan: ult high n no bridge 2/28/2006
RS = 24300.1

HEC-RAS Plan: ult hi n River: Amargosa Creek Reach: 1

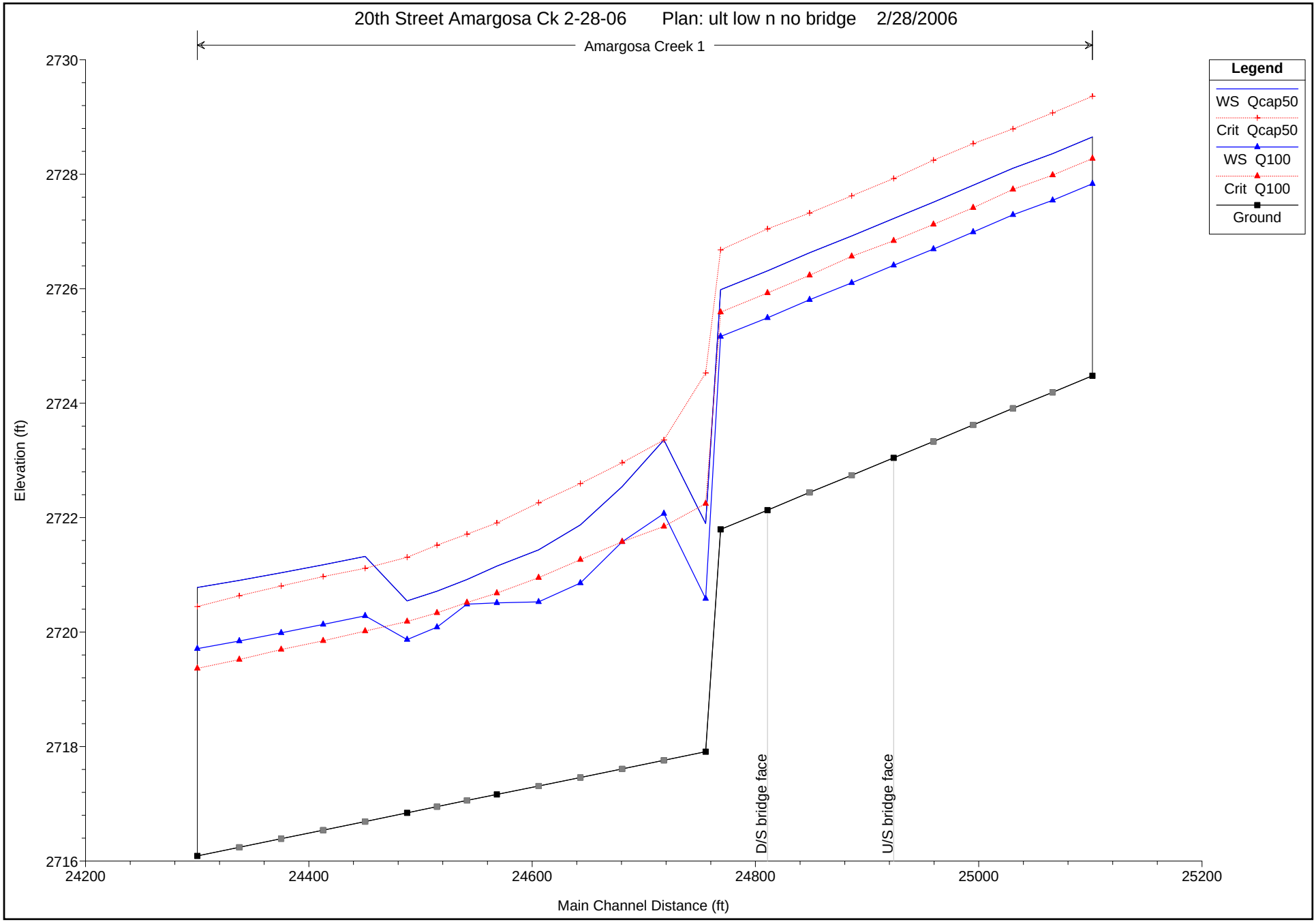
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	25100	Qcap50	3695.00	2724.48	2729.24	2729.36	2731.44	0.008101	11.91	310.15	78.01	1.05
1	25100	Q100	2350.00	2724.48	2728.27	2728.27	2729.83	0.008183	10.01	234.87	78.00	1.02
1	25064.5*	Qcap50	3695.00	2724.19	2728.97	2729.07	2731.15	0.007944	11.84	312.00	78.01	1.04
1	25064.5*	Q100	2350.00	2724.19	2727.98	2727.98	2729.54	0.008196	10.01	234.75	78.00	1.02
1	25029.0*	Qcap50	3695.00	2723.91	2728.69	2728.79	2730.87	0.007962	11.85	311.79	78.01	1.04
1	25029.0*	Q100	2350.00	2723.91	2727.69	2727.73	2729.26	0.008302	10.05	233.84	78.00	1.02
1	24993.6*	Qcap50	3695.00	2723.62	2728.44	2728.54	2730.58	0.007702	11.73	314.95	78.01	1.03
1	24993.6*	Q100	2350.00	2723.62	2727.40	2727.41	2728.97	0.008362	10.07	233.33	78.00	1.03
1	24958.1*	Qcap50	3695.00	2723.33	2728.24	2728.25	2730.29	0.007190	11.49	321.62	78.01	1.00
1	24958.1*	Q100	2350.00	2723.33	2727.10	2727.12	2728.68	0.008432	10.10	232.74	78.00	1.03
1	24922.7	Qcap50	3695.00	2723.04	2727.83	2727.93	2730.01	0.007933	11.84	312.13	78.01	1.04
1	24922.7	Q100	2350.00	2723.04	2726.80	2726.84	2728.40	0.008566	10.15	231.63	78.00	1.04
1	24885.1*	Qcap50	3695.00	2722.74	2727.56	2727.62	2729.70	0.007726	11.74	314.66	78.01	1.03
1	24885.1*	Q100	2350.00	2722.74	2726.47	2726.56	2728.09	0.008745	10.21	230.18	78.00	1.05
1	24847.5*	Qcap50	3695.00	2722.44	2727.31	2727.32	2729.40	0.007404	11.59	318.76	78.01	1.01
1	24847.5*	Q100	2350.00	2722.44	2726.15	2726.23	2727.80	0.009037	10.31	227.90	78.00	1.06
1	24810	Qcap50	3695.00	2722.13	2726.90	2727.05	2729.09	0.008068	11.90	310.54	78.01	1.05
1	24810	Q100	2350.00	2722.13	2725.81	2725.93	2727.49	0.009366	10.42	225.45	78.00	1.08
1	24768.6	Qcap50	3695.00	2721.80	2726.56	2726.68	2728.76	0.008086	11.91	310.32	78.01	1.05
1	24768.6	Q100	2350.00	2721.80	2725.45	2725.59	2727.16	0.009581	10.50	223.90	78.00	1.09
1	24755	Qcap50	3695.00	2717.91	2721.96	2724.53	2728.07	0.035896	19.84	186.20	46.01	1.74
1	24755	Q100	2350.00	2717.91	2720.57	2722.25	2726.30	0.057848	19.22	122.27	46.01	2.08
1	24717.6*	Qcap50	3695.00	2717.76	2722.37	2723.36	2726.46	0.020216	16.22	227.83	49.41	1.33
1	24717.6*	Q100	2350.00	2717.76	2721.21	2721.85	2724.16	0.021147	13.78	170.54	49.41	1.31
1	24680.3*	Qcap50	3695.00	2717.61	2723.08	2722.96	2725.62	0.010060	12.78	289.05	52.81	0.96
1	24680.3*	Q100	2350.00	2717.61	2722.02	2721.58	2723.60	0.008279	10.10	232.66	52.81	0.85

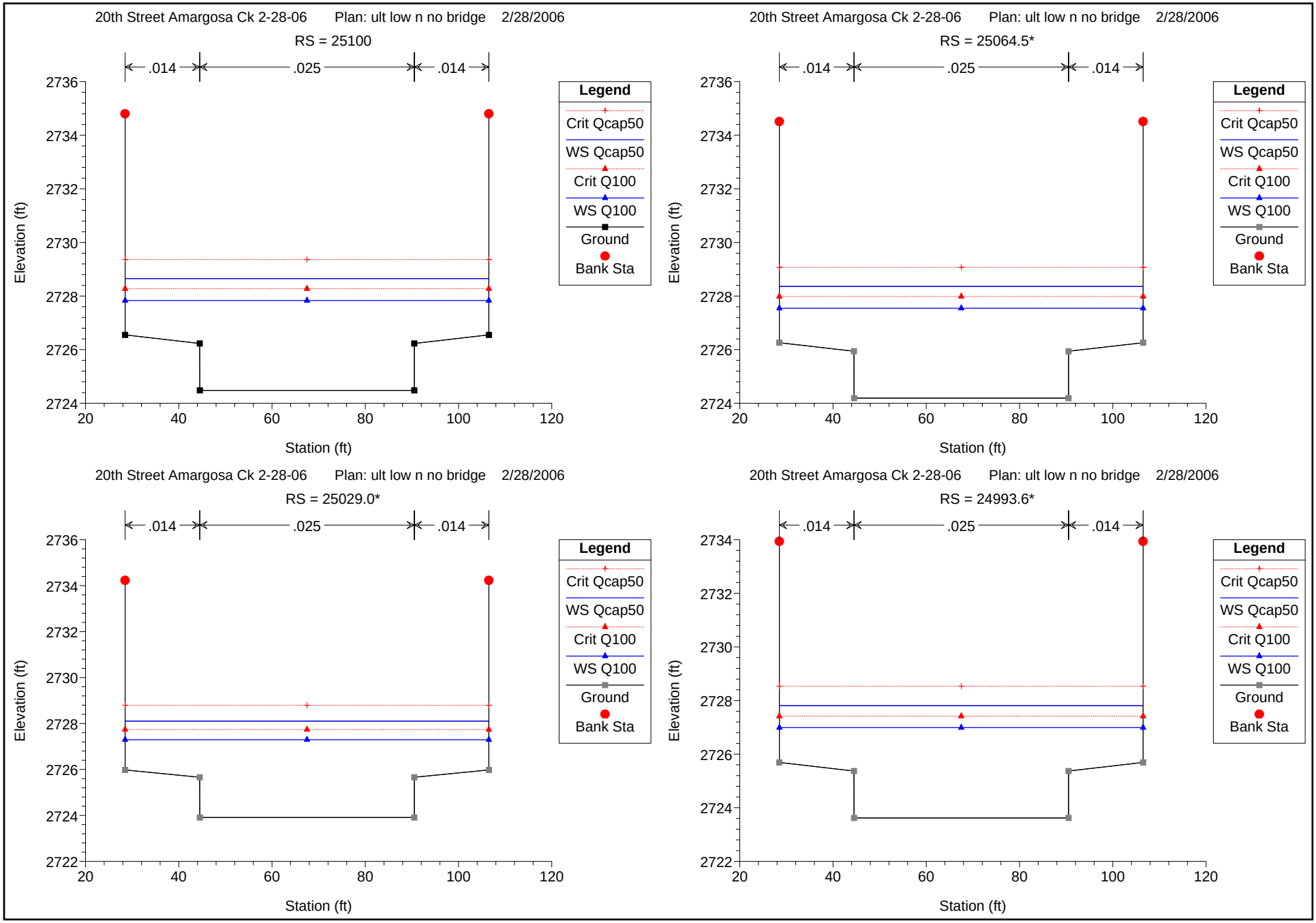
HEC-RAS Plan: ult hi n River: Amargosa Creek Reach: 1 (Continued)

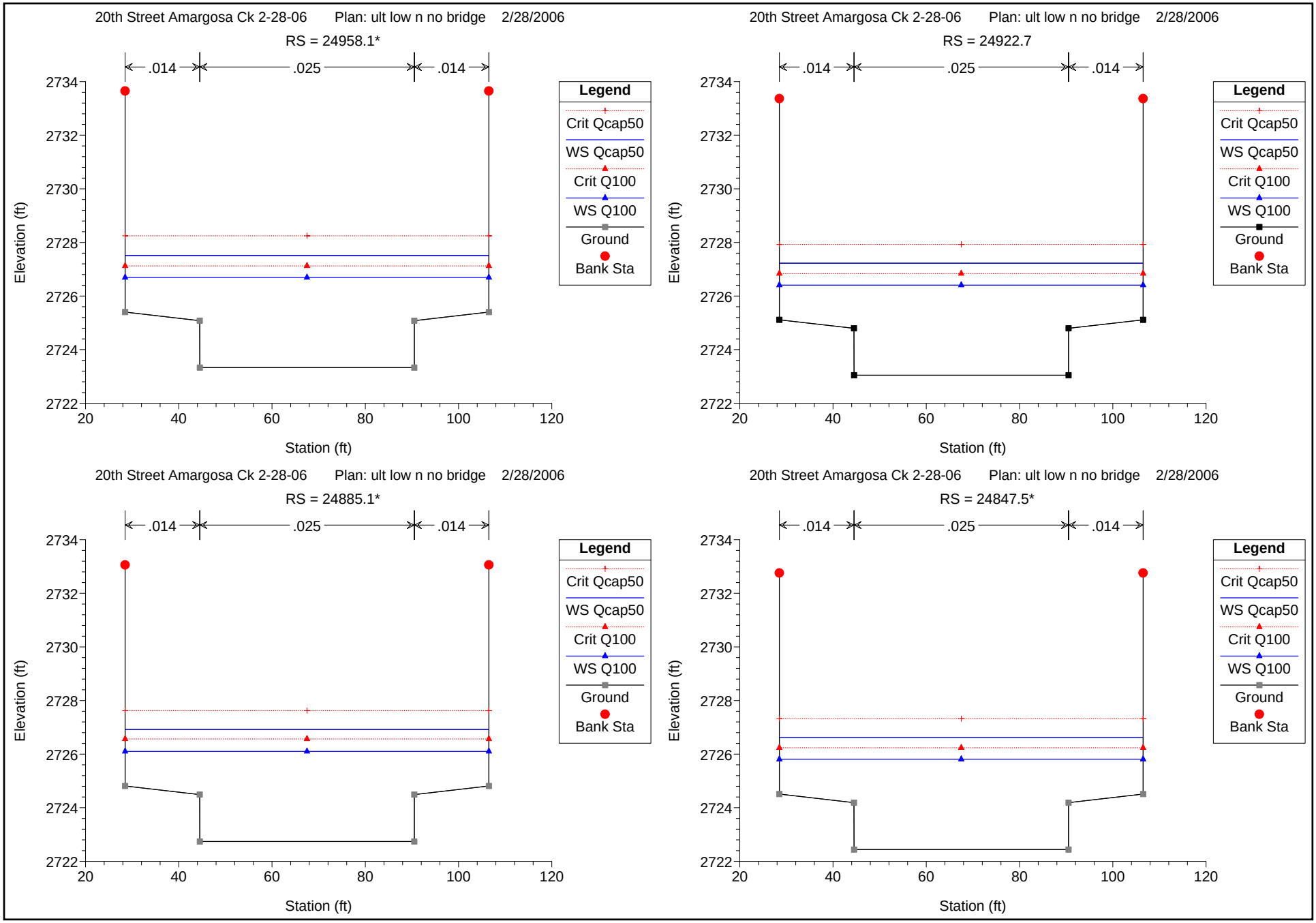
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	24642.9*	Qcap50	3695.00	2717.46	2722.95	2722.60	2725.18	0.008766	11.98	308.49	56.21	0.90
1	24642.9*	Q100	2350.00	2717.46	2721.84	2721.27	2723.26	0.007417	9.54	246.28	56.21	0.80
1	24605.6*	Qcap50	3695.00	2717.31	2722.83	2722.26	2724.79	0.007619	11.23	329.08	59.61	0.84
1	24605.6*	Q100	2350.00	2717.31	2721.69	2720.95	2722.95	0.006598	9.01	260.92	59.61	0.76
1	24568.3	Qcap50	3695.00	2717.16	2722.73	2721.91	2724.45	0.006626	10.54	350.56	63.01	0.79
1	24568.3	Q100	2350.00	2717.16	2721.55	2720.68	2722.67	0.005843	8.50	276.47	63.01	0.72
1	24541.5*	Qcap50	3695.00	2717.06	2722.72	2721.71	2724.21	0.006049	9.79	377.31	69.41	0.74
1	24541.5*	Q100	2350.00	2717.06	2721.48	2720.52	2722.49	0.005538	8.05	291.75	68.19	0.69
1	24514.7*	Qcap50	3695.00	2716.95	2722.72	2721.52	2724.00	0.005062	9.10	405.89	76.11	0.69
1	24514.7*	Q100	2350.00	2716.95	2721.42	2720.34	2722.32	0.004851	7.62	308.59	73.54	0.66
1	24487.9	Qcap50	3695.00	2716.84	2722.71	2721.31	2723.82	0.004305	8.47	436.40	83.16	0.65
1	24487.9	Q100	2350.00	2716.84	2721.36	2720.19	2722.16	0.004281	7.19	326.84	79.11	0.62
1	24450.3*	Qcap50	3695.00	2716.69	2722.56	2721.12	2723.66	0.004250	8.42	439.01	83.60	0.65
1	24450.3*	Q100	2350.00	2716.69	2721.21	2720.02	2722.00	0.004232	7.15	328.70	79.55	0.62
1	24412.7*	Qcap50	3695.00	2716.54	2722.41	2720.97	2723.50	0.004197	8.37	441.64	84.05	0.64
1	24412.7*	Q100	2350.00	2716.54	2721.05	2719.85	2721.84	0.004186	7.11	330.51	79.98	0.62
1	24375.2*	Qcap50	3695.00	2716.39	2722.26	2720.81	2723.34	0.004137	8.31	444.50	84.50	0.64
1	24375.2*	Q100	2350.00	2716.39	2720.91	2719.70	2721.68	0.004133	7.07	332.52	80.43	0.61
1	24337.6*	Qcap50	3695.00	2716.24	2722.12	2720.63	2723.18	0.004073	8.26	447.53	84.95	0.63
1	24337.6*	Q100	2350.00	2716.24	2720.76	2719.52	2721.52	0.004073	7.02	334.71	80.87	0.61
1	24300.1	Qcap50	3695.00	2716.09	2721.98	2720.45	2723.02	0.004001	8.19	450.96	85.43	0.63
1	24300.1	Q100	2350.00	2716.09	2720.61	2719.37	2721.37	0.004003	6.97	337.25	81.34	0.60

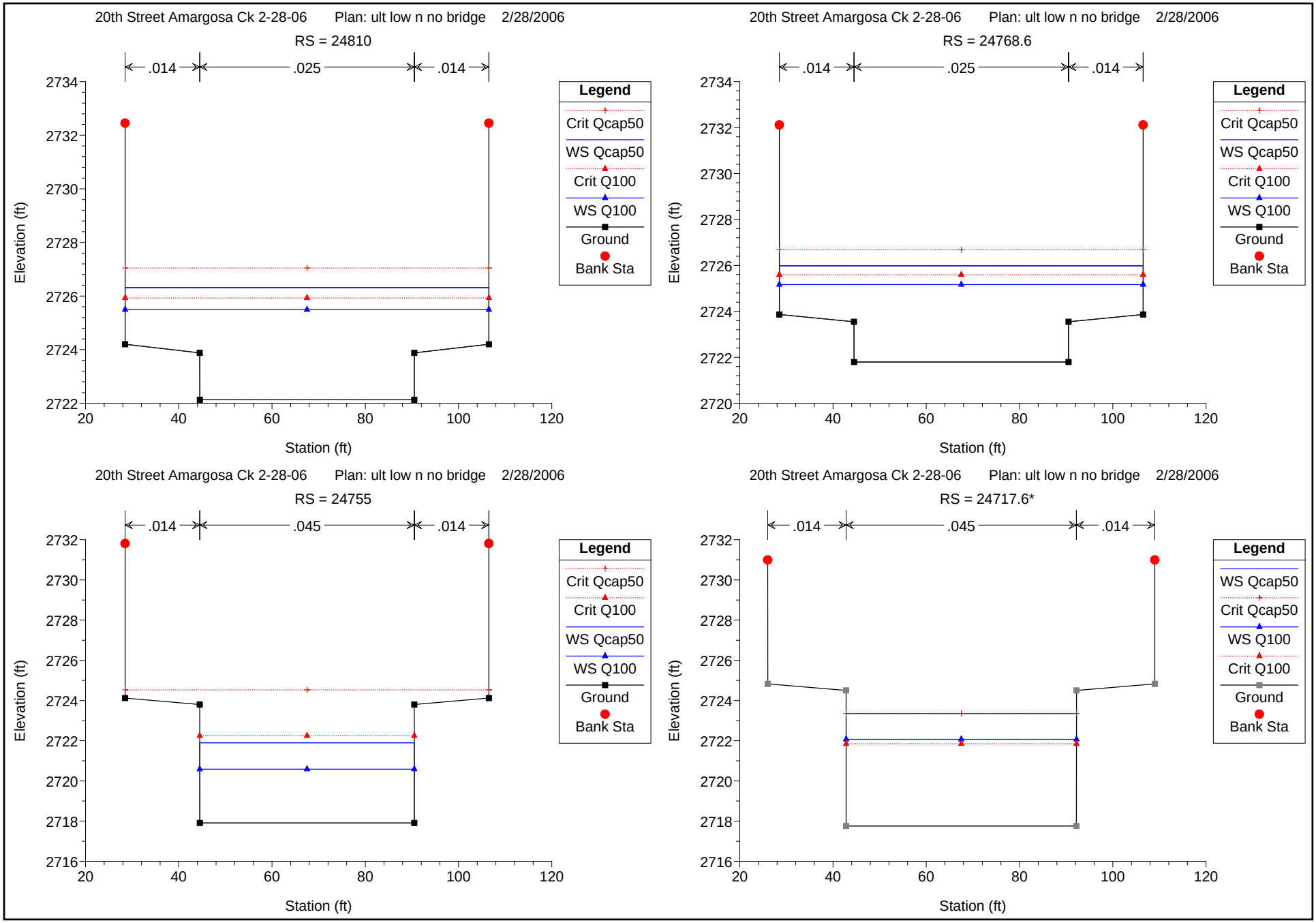
Ultimate Conditions

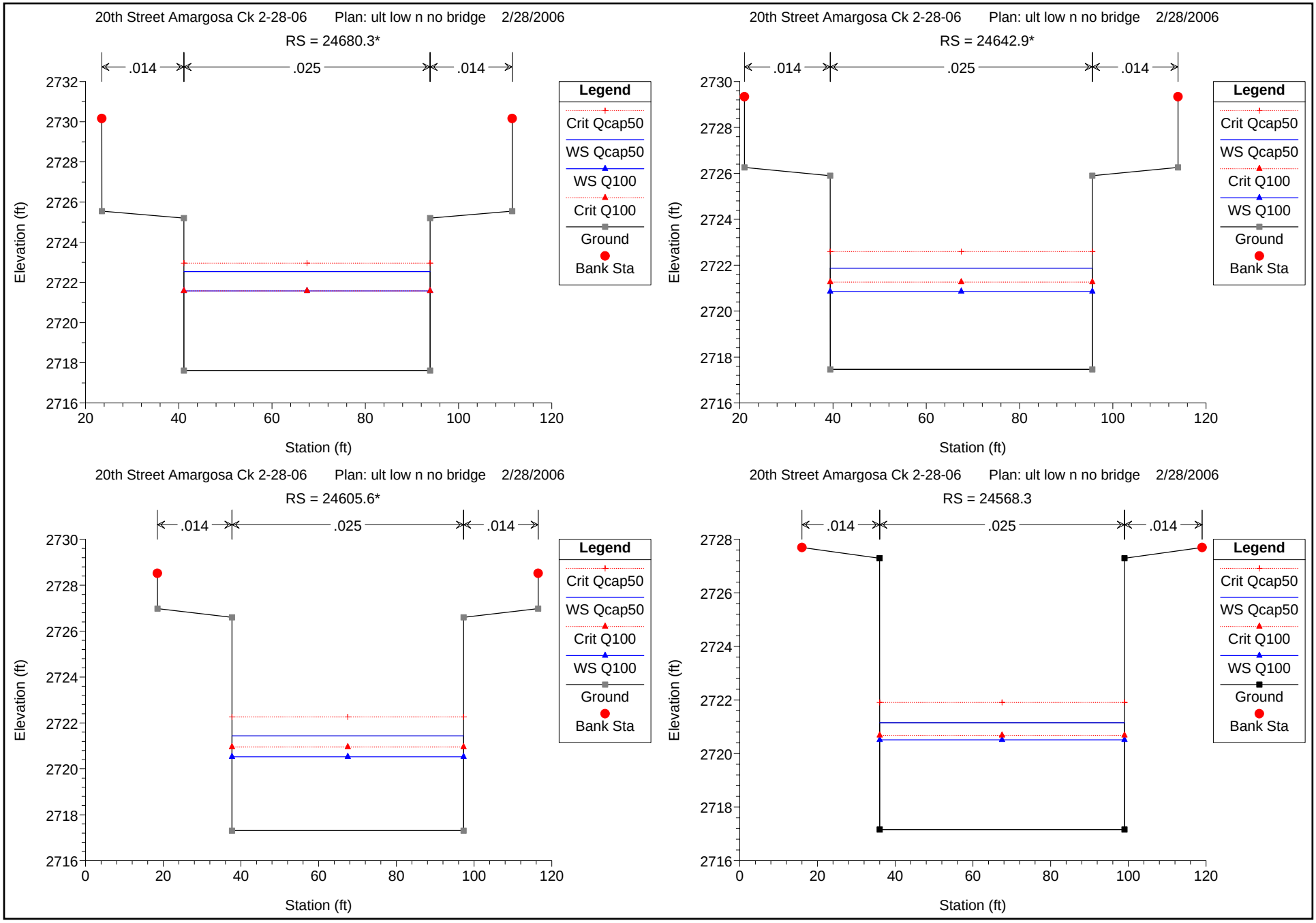
Low Manning's *n*
(for scour evaluation)

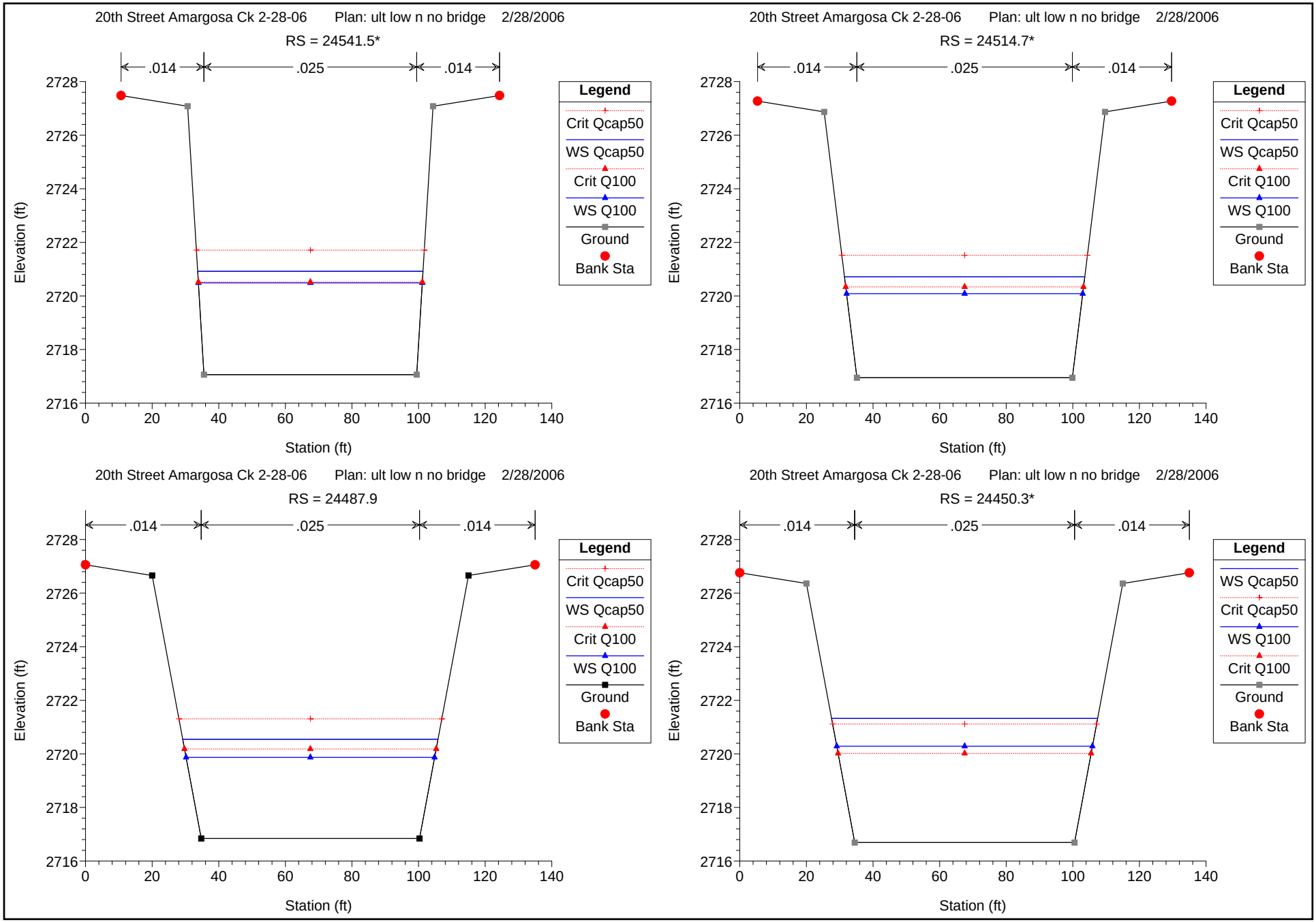

20th Street Amargosa Ck 2-28-06 Plan: ult low n no bridge 2/28/2006
Amargosa Creek 1
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Elevation (ft)
2730
2728
2726
2724
2722
2720
2718
2716
24200
24400
24600
24800
25000
25200
Main Channel Distance (ft)
D/S bridge face
U/S bridge face

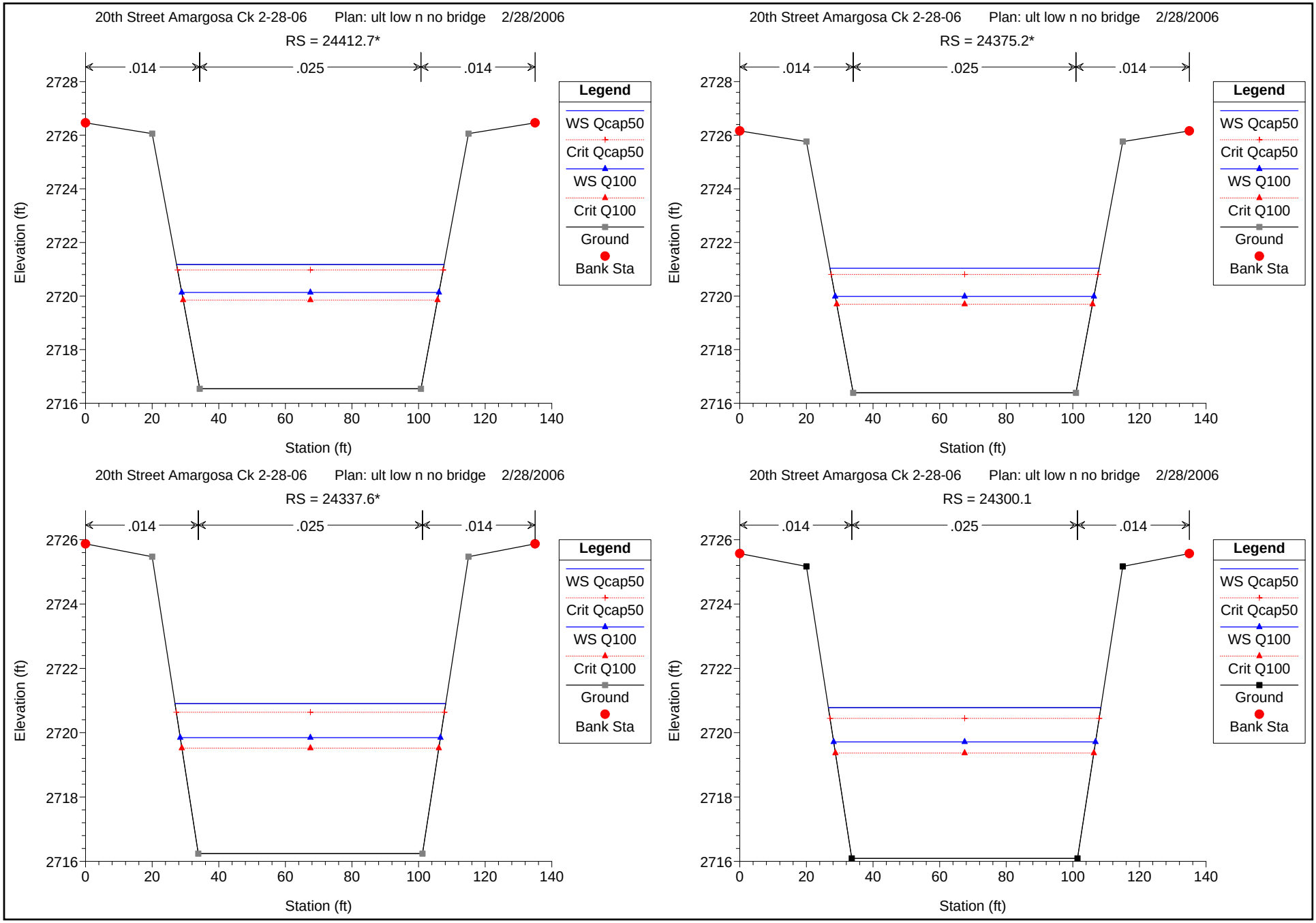

20th Street Amargosa Ck 2-28-06 Plan: ult low n no bridge 2/28/2006
RS = 25100
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult low n no bridge 2/28/2006
RS = 25064.5*
20th Street Amargosa Ck 2-28-06 Plan: ult low n no bridge 2/28/2006
RS = 25029.0*
20th Street Amargosa Ck 2-28-06 Plan: ult low n no bridge 2/28/2006
RS = 24993.6*


20th Street Amargosa Ck 2-28-06 Plan: ult low n no bridge 2/28/2006
RS = 24958.1*
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult low n no bridge 2/28/2006
RS = 24922.7
20th Street Amargosa Ck 2-28-06 Plan: ult low n no bridge 2/28/2006
RS = 24885.1*
20th Street Amargosa Ck 2-28-06 Plan: ult low n no bridge 2/28/2006
RS = 24847.5*


20th Street Amargosa Ck 2-28-06 Plan: ult low n no bridge 2/28/2006
RS = 24810
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult low n no bridge 2/28/2006
RS = 24768.6
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult low n no bridge 2/28/2006
RS = 24755
.014
.045
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
Crit Q100
WS Qcap50
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult low n no bridge 2/28/2006
RS = 24717.6*
.014
.045
.014
Elevation (ft)
Station (ft)
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Bank Sta


20th Street Amargosa Ck 2-28-06 Plan: ult low n no bridge 2/28/2006
RS = 24680.3*
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
WS Q100
Crit Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult low n no bridge 2/28/2006
RS = 24642.9*
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult low n no bridge 2/28/2006
RS = 24605.6*
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult low n no bridge 2/28/2006
RS = 24568.3
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta


20th Street Amargosa Ck 2-28-06 Plan: ult low n no bridge 2/28/2006
RS = 24541.5*
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult low n no bridge 2/28/2006
RS = 24514.7*
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult low n no bridge 2/28/2006
RS = 24487.9
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult low n no bridge 2/28/2006
RS = 24450.3*
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Bank Sta


20th Street Amargosa Ck 2-28-06 Plan: ult low n no bridge 2/28/2006
RS = 24412.7*
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult low n no bridge 2/28/2006
RS = 24375.2*
20th Street Amargosa Ck 2-28-06 Plan: ult low n no bridge 2/28/2006
RS = 24337.6*
20th Street Amargosa Ck 2-28-06 Plan: ult low n no bridge 2/28/2006
RS = 24300.1

HEC-RAS Plan: ult lo n River: Amargosa Creek Reach: 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	25100	Qcap50	3695.00	2724.48	2728.65	2729.36	2731.69	0.008114	13.98	264.29	78.01	1.34
1	25100	Q100	2350.00	2724.48	2727.83	2728.27	2729.97	0.008115	11.72	200.55	78.00	1.29
1	25064.5*	Qcap50	3695.00	2724.19	2728.36	2729.07	2731.40	0.008126	13.99	264.18	78.01	1.34
1	25064.5*	Q100	2350.00	2724.19	2727.54	2727.98	2729.68	0.008123	11.72	200.49	78.00	1.29
1	25029.0*	Qcap50	3695.00	2723.91	2728.10	2728.79	2731.10	0.007942	13.89	266.03	78.01	1.33
1	25029.0*	Q100	2350.00	2723.91	2727.29	2727.73	2729.38	0.007843	11.60	202.65	78.00	1.27
1	24993.6*	Qcap50	3695.00	2723.62	2727.81	2728.54	2730.82	0.007992	13.92	265.51	78.01	1.33
1	24993.6*	Q100	2350.00	2723.62	2726.99	2727.41	2729.10	0.007955	11.65	201.77	78.00	1.28
1	24958.1*	Qcap50	3695.00	2723.33	2727.51	2728.25	2730.53	0.008034	13.94	265.10	78.01	1.33
1	24958.1*	Q100	2350.00	2723.33	2726.69	2727.12	2728.81	0.008027	11.68	201.22	78.00	1.28
1	24922.7	Qcap50	3695.00	2723.04	2727.23	2727.93	2730.24	0.008027	13.93	265.17	78.01	1.33
1	24922.7	Q100	2350.00	2723.04	2726.41	2726.84	2728.52	0.008010	11.67	201.35	78.00	1.28
1	24885.1*	Qcap50	3695.00	2722.74	2726.92	2727.62	2729.94	0.008038	13.94	265.05	78.01	1.33
1	24885.1*	Q100	2350.00	2722.74	2726.10	2726.56	2728.22	0.008035	11.68	201.16	78.00	1.28
1	24847.5*	Qcap50	3695.00	2722.44	2726.63	2727.32	2729.63	0.007987	13.91	265.57	78.01	1.33
1	24847.5*	Q100	2350.00	2722.44	2725.81	2726.23	2727.92	0.007977	11.66	201.60	78.00	1.28
1	24810	Qcap50	3695.00	2722.13	2726.31	2727.05	2729.33	0.008043	13.94	265.00	78.01	1.33
1	24810	Q100	2350.00	2722.13	2725.49	2725.93	2727.61	0.008064	11.70	200.94	78.00	1.28
1	24768.6	Qcap50	3695.00	2721.80	2725.98	2726.68	2728.99	0.007994	13.92	265.49	78.01	1.33
1	24768.6	Q100	2350.00	2721.80	2725.17	2725.59	2727.27	0.007965	11.65	201.69	78.00	1.28
1	24755	Qcap50	3695.00	2717.91	2721.90	2724.53	2728.20	0.061187	20.14	183.47	46.01	1.78
1	24755	Q100	2350.00	2717.91	2720.59	2722.25	2726.24	0.092368	19.09	123.11	46.01	2.06
1	24717.6*	Qcap50	3695.00	2717.76	2723.36	2723.36	2726.13	0.017339	13.36	276.56	49.42	1.00
1	24717.6*	Q100	2350.00	2717.76	2722.07	2721.85	2723.96	0.016549	11.03	213.02	49.41	0.94
1	24680.3*	Qcap50	3695.00	2717.61	2722.54	2722.96	2725.67	0.007509	14.19	260.38	52.81	1.13
1	24680.3*	Q100	2350.00	2717.61	2721.58	2721.58	2723.53	0.006148	11.22	209.53	52.81	0.99

HEC-RAS Plan: ult lo n River: Amargosa Creek Reach: 1 (Continued)

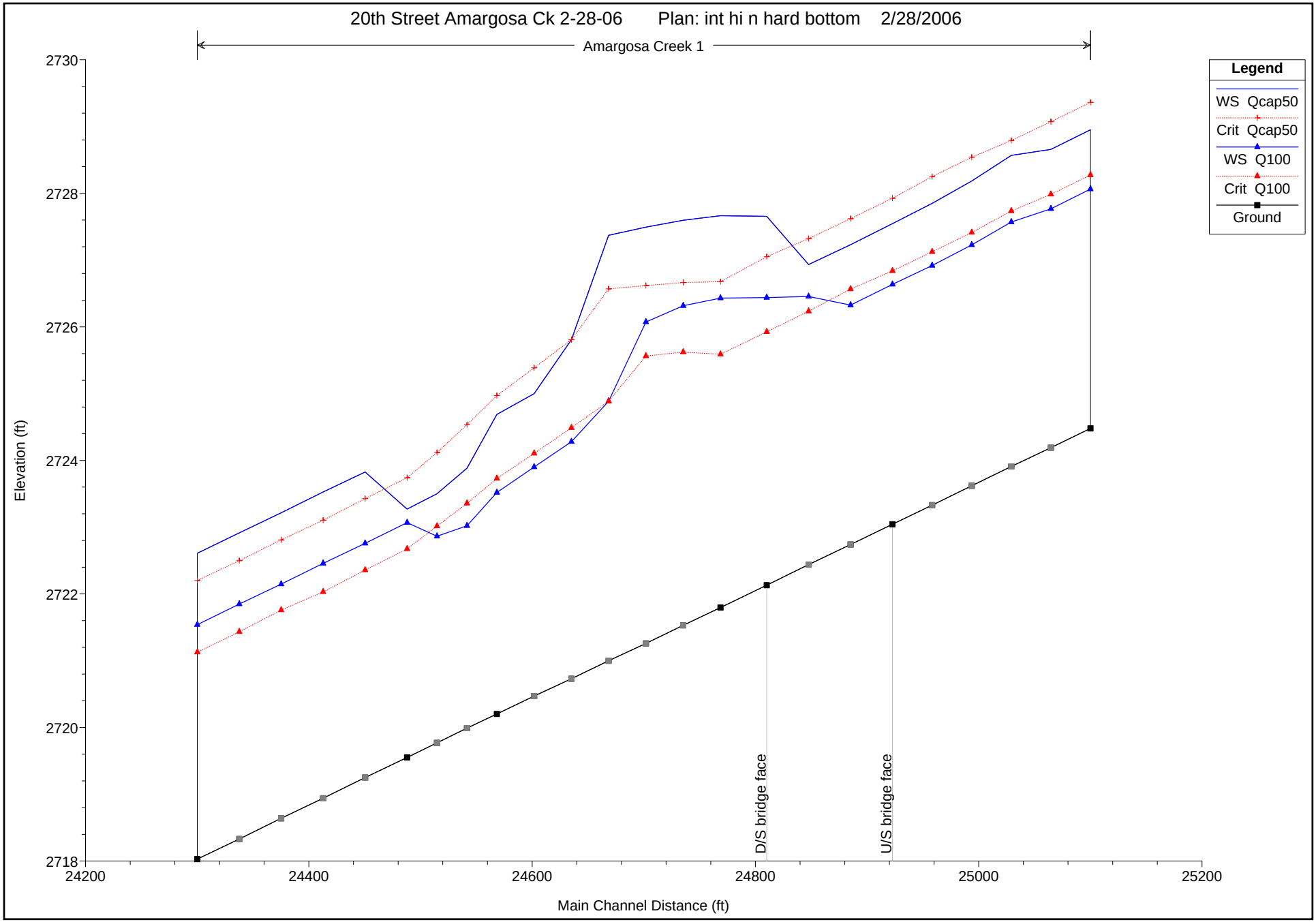
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	24642.9*	Qcap50	3695.00	2717.46	2721.87	2722.60	2725.32	0.009450	14.90	248.01	56.21	1.25
1	24642.9*	Q100	2350.00	2717.46	2720.86	2721.27	2723.21	0.008959	12.30	190.99	56.21	1.18
1	24605.6*	Qcap50	3695.00	2717.31	2721.44	2722.26	2724.94	0.010407	15.02	245.94	59.61	1.30
1	24605.6*	Q100	2350.00	2717.31	2720.53	2720.95	2722.86	0.009480	12.25	191.85	59.61	1.20
1	24568.3	Qcap50	3695.00	2717.16	2721.15	2721.91	2724.51	0.010352	14.70	251.39	63.01	1.30
1	24568.3	Q100	2350.00	2717.16	2720.51	2720.68	2722.44	0.007436	11.14	210.91	63.01	1.07
1	24541.5*	Qcap50	3695.00	2717.06	2720.92	2721.71	2724.21	0.010273	14.57	253.66	67.64	1.33
1	24541.5*	Q100	2350.00	2717.06	2720.49	2720.52	2722.19	0.006172	10.46	224.73	67.22	1.01
1	24514.7*	Qcap50	3695.00	2716.95	2720.71	2721.52	2723.91	0.010088	14.35	257.57	72.15	1.34
1	24514.7*	Q100	2350.00	2716.95	2720.09	2720.34	2721.98	0.007620	11.05	212.63	70.91	1.12
1	24487.9	Qcap50	3695.00	2716.84	2720.55	2721.31	2723.60	0.009738	14.03	263.31	76.66	1.33
1	24487.9	Q100	2350.00	2716.84	2719.87	2720.19	2721.77	0.007941	11.08	212.13	74.63	1.16
1	24450.3*	Qcap50	3695.00	2716.69	2721.32	2721.12	2723.18	0.004386	10.93	337.93	79.89	0.94
1	24450.3*	Q100	2350.00	2716.69	2720.29	2720.02	2721.59	0.004313	9.16	256.65	76.78	0.88
1	24412.7*	Qcap50	3695.00	2716.54	2721.18	2720.97	2723.01	0.004322	10.86	340.27	80.35	0.93
1	24412.7*	Q100	2350.00	2716.54	2720.13	2719.85	2721.42	0.004266	9.10	258.12	77.22	0.88
1	24375.2*	Qcap50	3695.00	2716.39	2721.04	2720.81	2722.84	0.004236	10.77	343.17	80.82	0.92
1	24375.2*	Q100	2350.00	2716.39	2719.99	2719.70	2721.26	0.004199	9.04	259.99	77.68	0.87
1	24337.6*	Qcap50	3695.00	2716.24	2720.90	2720.63	2722.67	0.004135	10.66	346.52	81.30	0.91
1	24337.6*	Q100	2350.00	2716.24	2719.85	2719.52	2721.09	0.004116	8.96	262.19	78.13	0.86
1	24300.1	Qcap50	3695.00	2716.09	2720.78	2720.45	2722.50	0.004006	10.53	350.75	81.83	0.90
1	24300.1	Q100	2350.00	2716.09	2719.71	2719.37	2720.93	0.004003	8.86	265.09	78.63	0.85

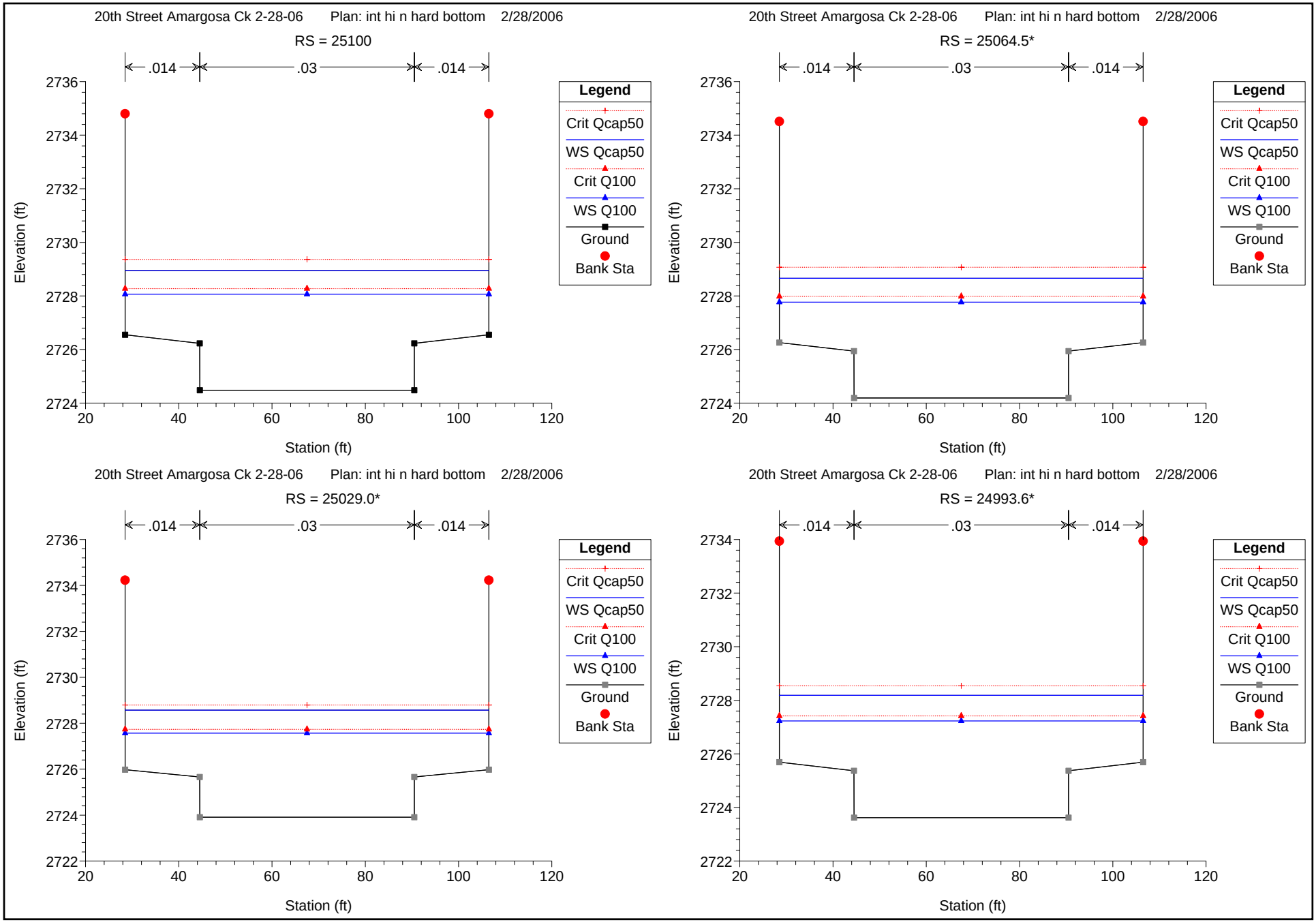
Appendix B

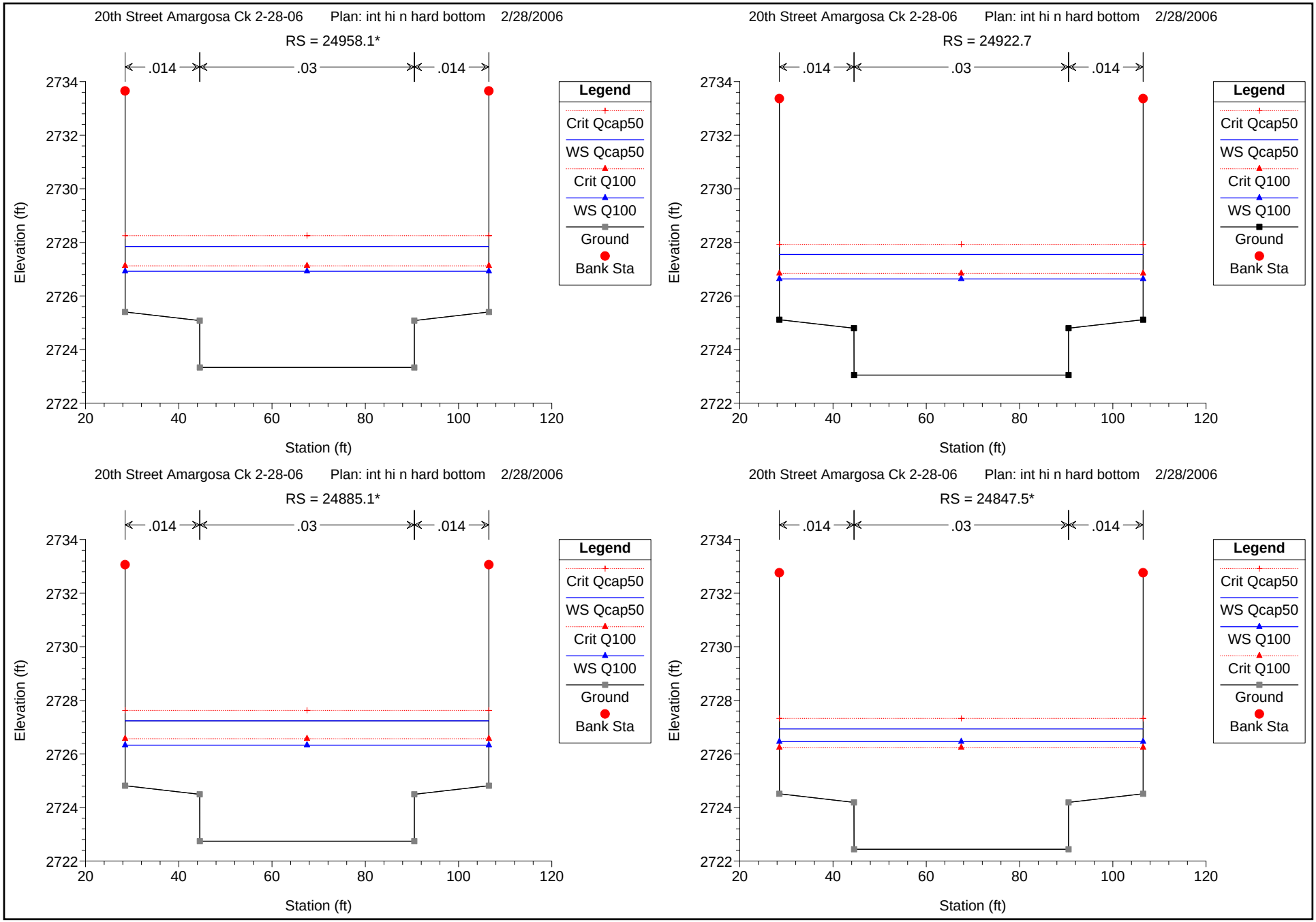
Hard Bottom Alternatives
HEC-RAS Model Input/Output

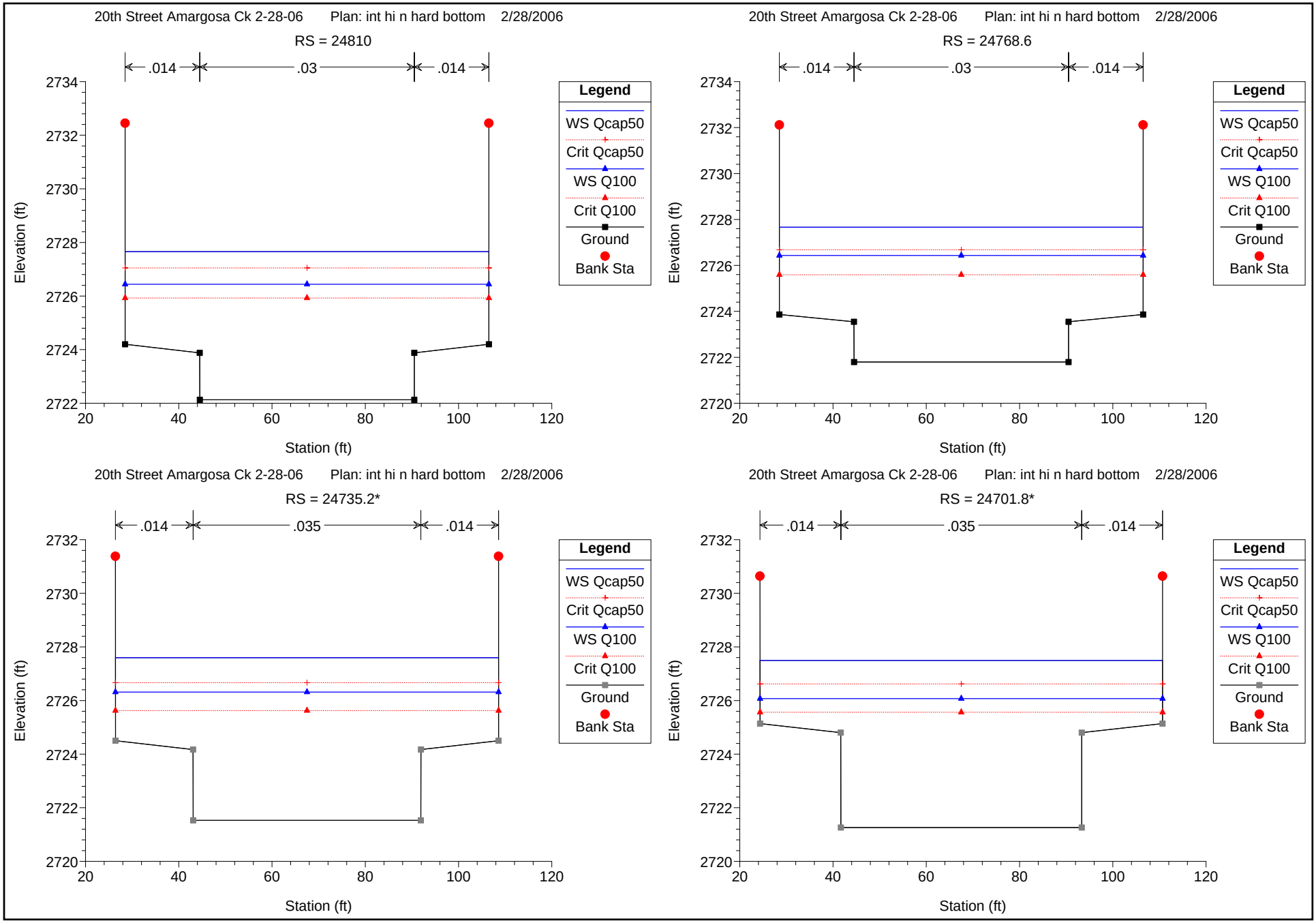
Interim Conditions

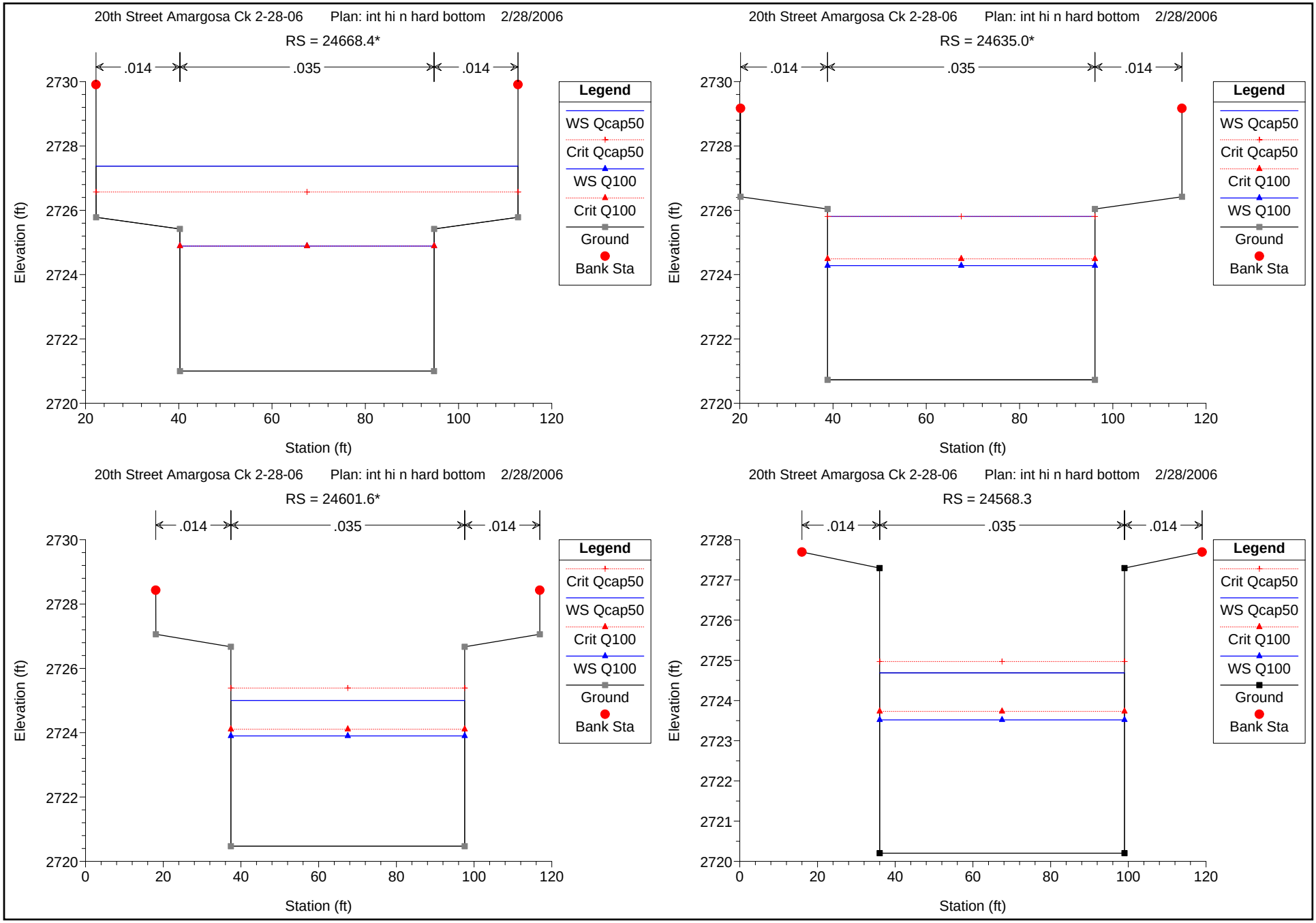
High Manning's *n*
(for freeboard evaluation)

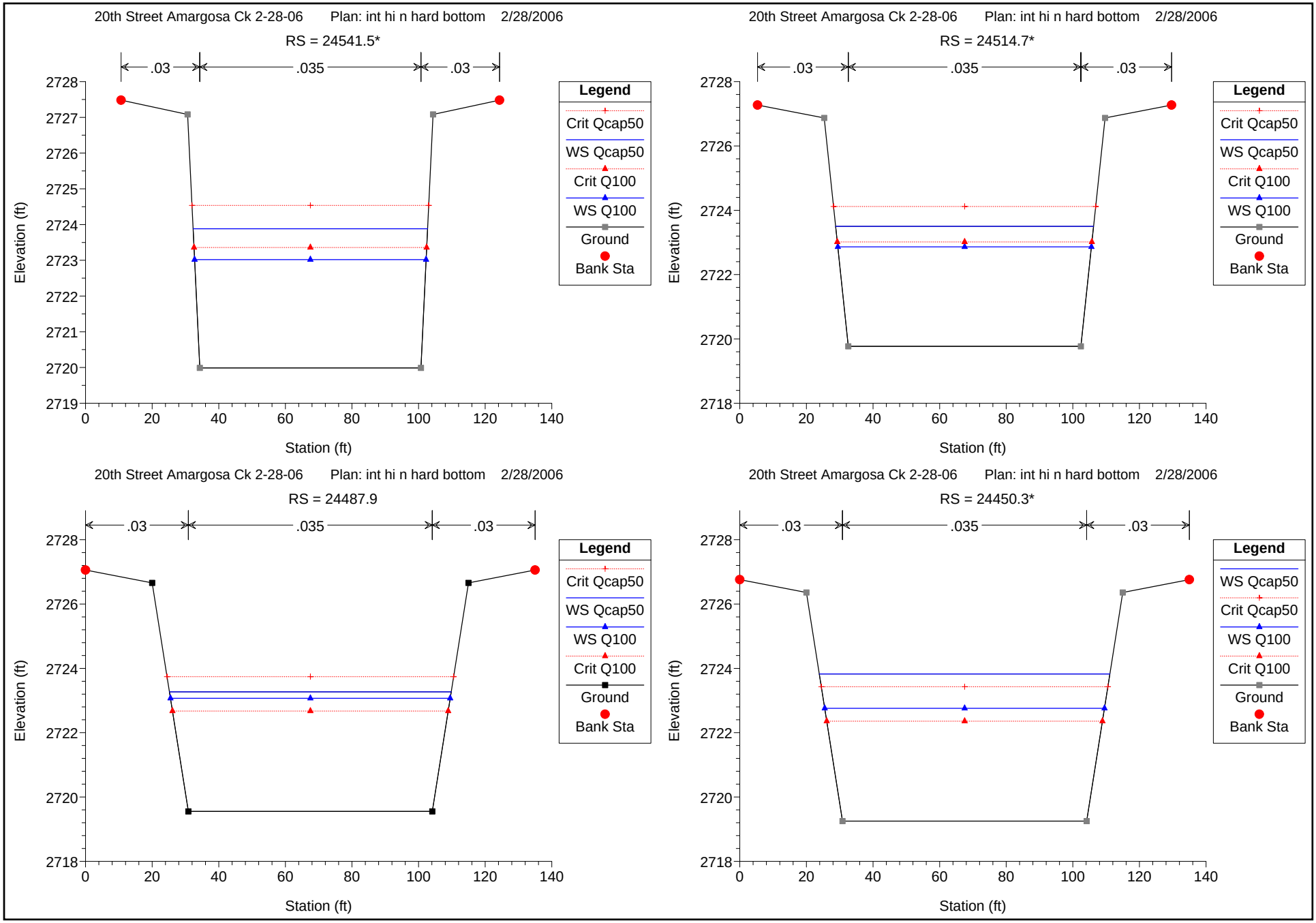

20th Street Amargosa Ck 2-28-06 Plan: int hi n hard bottom 2/28/2006
Amargosa Creek 1
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Elevation (ft)
2730
2728
2726
2724
2722
2720
2718
24200
24400
24600
24800
25000
25200
Main Channel Distance (ft)
D/S bridge face
U/S bridge face

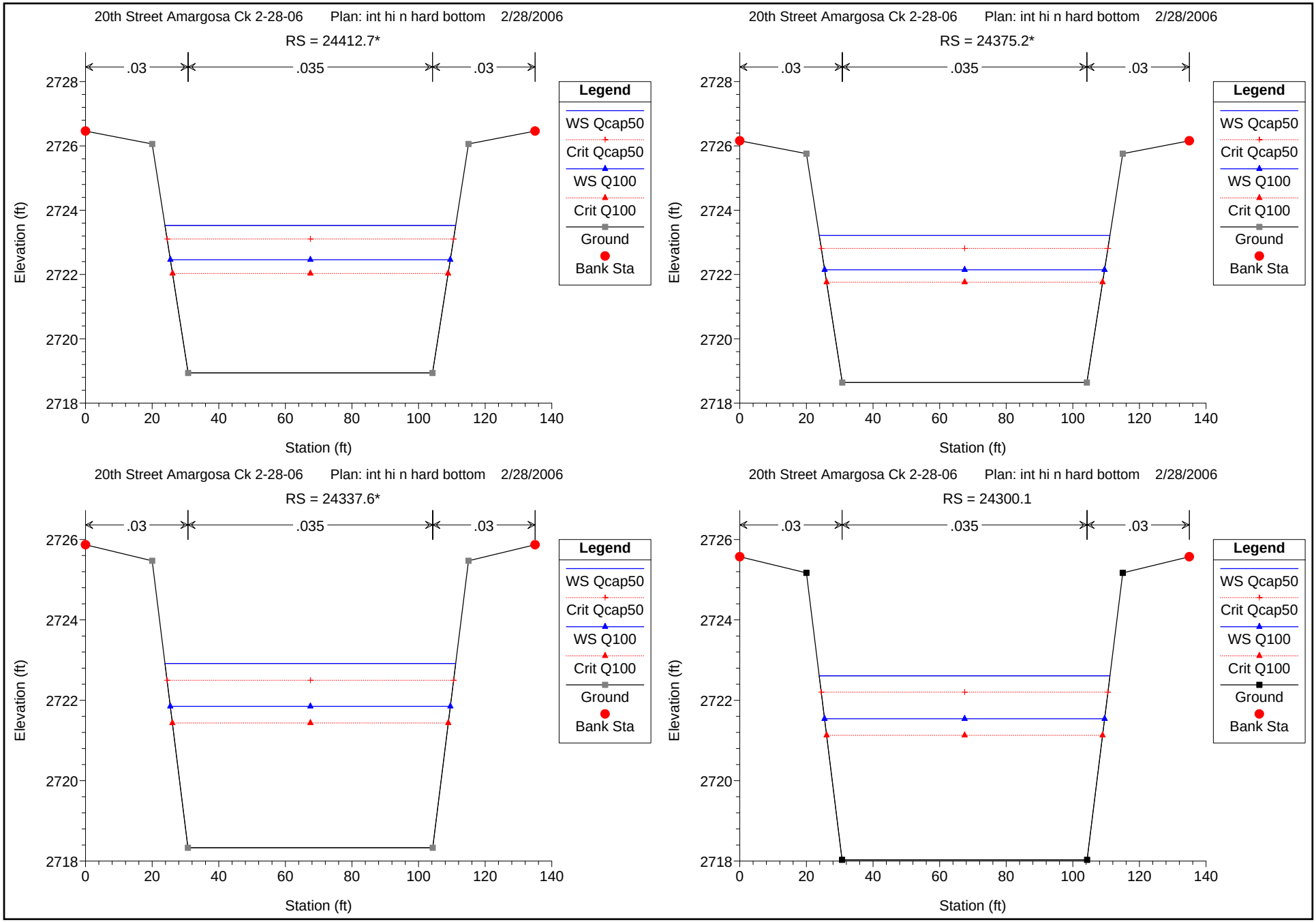

20th Street Amargosa Ck 2-28-06 Plan: int hi n hard bottom 2/28/2006
RS = 25100
.014
.03
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int hi n hard bottom 2/28/2006
RS = 25064.5*
20th Street Amargosa Ck 2-28-06 Plan: int hi n hard bottom 2/28/2006
RS = 25029.0*
20th Street Amargosa Ck 2-28-06 Plan: int hi n hard bottom 2/28/2006
RS = 24993.6*


20th Street Amargosa Ck 2-28-06 Plan: int hi n hard bottom 2/28/2006
RS = 24958.1*
.014
.03
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int hi n hard bottom 2/28/2006
RS = 24922.7
20th Street Amargosa Ck 2-28-06 Plan: int hi n hard bottom 2/28/2006
RS = 24885.1*
20th Street Amargosa Ck 2-28-06 Plan: int hi n hard bottom 2/28/2006
RS = 24847.5*


20th Street Amargosa Ck 2-28-06 Plan: int hi n hard bottom 2/28/2006
RS = 24810
.014
.03
.014
Elevation (ft)
Station (ft)
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int hi n hard bottom 2/28/2006
RS = 24768.6
.014
.03
.014
Elevation (ft)
Station (ft)
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int hi n hard bottom 2/28/2006
RS = 24735.2*
.014
.035
.014
Elevation (ft)
Station (ft)
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int hi n hard bottom 2/28/2006
RS = 24701.8*
.014
.035
.014
Elevation (ft)
Station (ft)
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Bank Sta


20th Street Amargosa Ck 2-28-06 Plan: int hi n hard bottom 2/28/2006
RS = 24668.4*
.014
.035
.014
Elevation (ft)
Station (ft)
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int hi n hard bottom 2/28/2006
RS = 24635.0*
.014
.035
.014
Elevation (ft)
Station (ft)
Legend
WS Qcap50
Crit Qcap50
Crit Q100
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int hi n hard bottom 2/28/2006
RS = 24601.6*
.014
.035
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int hi n hard bottom 2/28/2006
RS = 24568.3
.014
.035
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta


20th Street Amargosa Ck 2-28-06 Plan: int hi n hard bottom 2/28/2006
RS = 24541.5*
.03
.035
.03
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int hi n hard bottom 2/28/2006
RS = 24514.7*
.03
.035
.03
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int hi n hard bottom 2/28/2006
RS = 24487.9
.03
.035
.03
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
WS Q100
Crit Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int hi n hard bottom 2/28/2006
RS = 24450.3*
.03
.035
.03
Elevation (ft)
Station (ft)
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Bank Sta


20th Street Amargosa Ck 2-28-06 Plan: int hi n hard bottom 2/28/2006
RS = 24412.7*
.03
.035
.03
Elevation (ft)
Station (ft)
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int hi n hard bottom 2/28/2006
RS = 24375.2*
20th Street Amargosa Ck 2-28-06 Plan: int hi n hard bottom 2/28/2006
RS = 24337.6*
20th Street Amargosa Ck 2-28-06 Plan: int hi n hard bottom 2/28/2006
RS = 24300.1

HEC-RAS Plan: int hi n hb River: Amargosa Creek Reach: 1

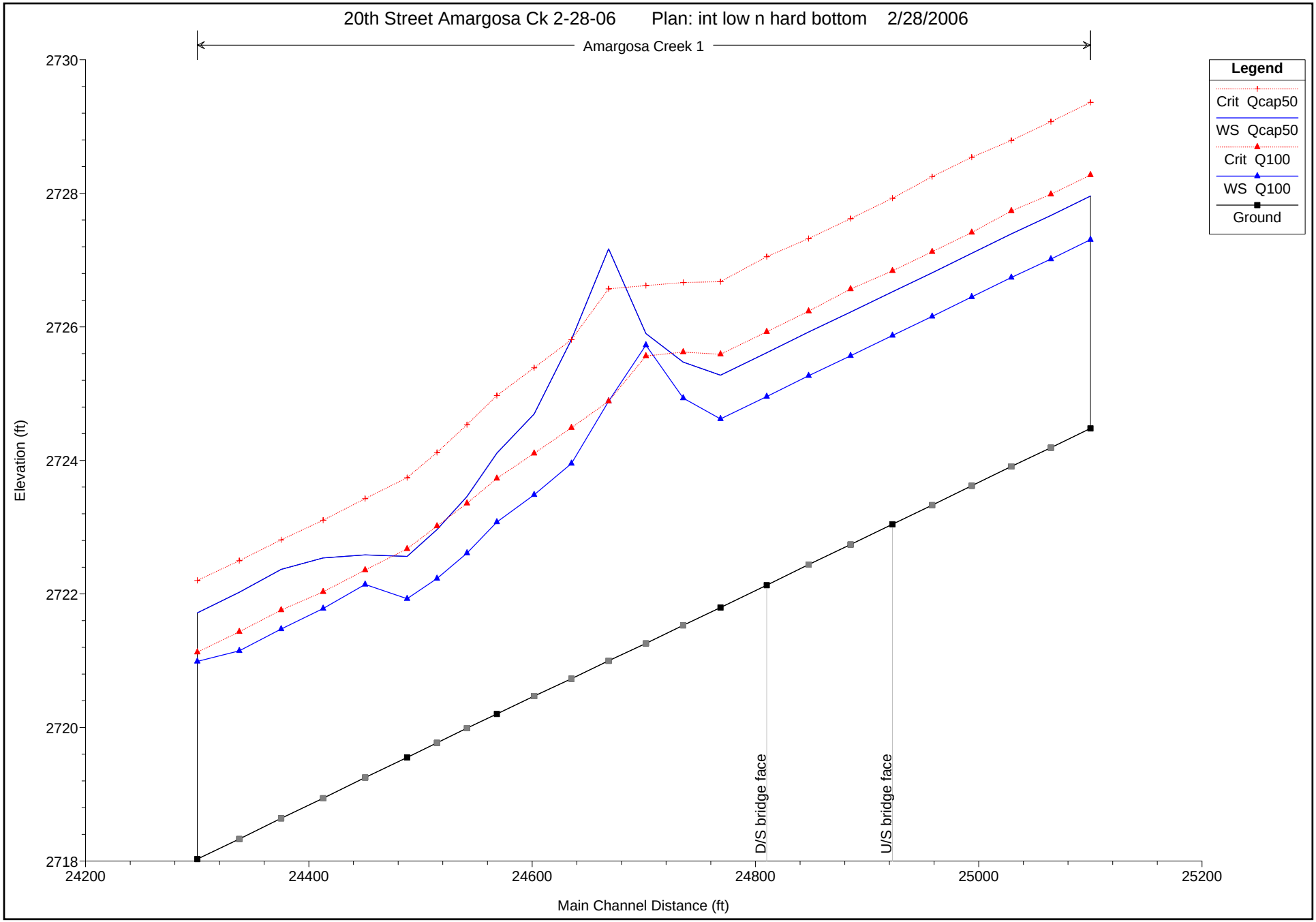
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	25100	Qcap50	3695.00	2724.48	2728.95	2729.36	2731.51	0.008106	12.85	287.66	78.01	1.18
1	25100	Q100	2350.00	2724.48	2728.06	2728.27	2729.86	0.008103	10.76	218.43	78.00	1.13
1	25064.5*	Qcap50	3695.00	2724.19	2728.66	2729.07	2731.22	0.008129	12.86	287.41	78.01	1.18
1	25064.5*	Q100	2350.00	2724.19	2727.77	2727.98	2729.57	0.008157	10.78	218.00	78.00	1.14
1	25029.0*	Qcap50	3695.00	2723.91	2728.57	2728.79	2730.89	0.006890	12.22	302.29	78.01	1.09
1	25029.0*	Q100	2350.00	2723.91	2727.57	2727.74	2729.27	0.007410	10.47	224.45	78.00	1.09
1	24993.6*	Qcap50	3695.00	2723.62	2728.18	2728.54	2730.62	0.007473	12.53	294.88	78.01	1.14
1	24993.6*	Q100	2350.00	2723.62	2727.23	2727.41	2729.00	0.007886	10.67	220.25	78.00	1.12
1	24958.1*	Qcap50	3695.00	2723.33	2727.85	2728.25	2730.35	0.007772	12.68	291.38	78.01	1.16
1	24958.1*	Q100	2350.00	2723.33	2726.92	2727.12	2728.71	0.008059	10.74	218.80	78.00	1.13
1	24922.7	Qcap50	3695.00	2723.04	2727.55	2727.93	2730.07	0.007892	12.74	290.02	78.01	1.16
1	24922.7	Q100	2350.00	2723.04	2726.64	2726.84	2728.42	0.008027	10.73	219.06	78.00	1.13
1	24885.1*	Qcap50	3695.00	2722.74	2727.23	2727.62	2729.77	0.007965	12.78	289.20	78.01	1.17
1	24885.1*	Q100	2350.00	2722.74	2726.33	2726.57	2728.12	0.008075	10.75	218.66	78.00	1.13
1	24847.5*	Qcap50	3695.00	2722.44	2726.93	2727.32	2729.47	0.007950	12.77	289.37	78.01	1.17
1	24847.5*	Q100	2350.00	2722.44	2726.46	2726.23	2727.81	0.005054	9.32	252.14	78.00	0.91
1	24810	Qcap50	3695.00	2722.13	2727.66	2727.05	2729.21	0.003564	9.99	369.77	78.01	0.81
1	24810	Q100	2350.00	2722.13	2726.44	2725.93	2727.57	0.003803	8.55	274.96	78.01	0.80
1	24768.6	Qcap50	3695.00	2721.80	2727.67	2726.68	2729.01	0.002834	9.32	396.67	78.01	0.73
1	24768.6	Q100	2350.00	2721.80	2726.43	2725.59	2727.38	0.002844	7.82	300.42	78.01	0.70
1	24735.2*	Qcap50	3695.00	2721.53	2727.60	2726.67	2728.89	0.003633	9.12	405.04	82.17	0.72
1	24735.2*	Q100	2350.00	2721.53	2726.32	2725.62	2727.27	0.003950	7.84	299.76	82.17	0.72
1	24701.8*	Qcap50	3695.00	2721.26	2727.49	2726.62	2728.76	0.003755	9.02	409.53	86.33	0.73
1	24701.8*	Q100	2350.00	2721.26	2726.07	2725.56	2727.12	0.004899	8.19	286.89	86.32	0.79
1	24668.4*	Qcap50	3695.00	2721.00	2727.37	2726.57	2728.63	0.003966	8.99	410.97	90.50	0.74
1	24668.4*	Q100	2350.00	2721.00	2724.89	2724.89	2726.80	0.011711	11.09	211.85	54.52	0.99

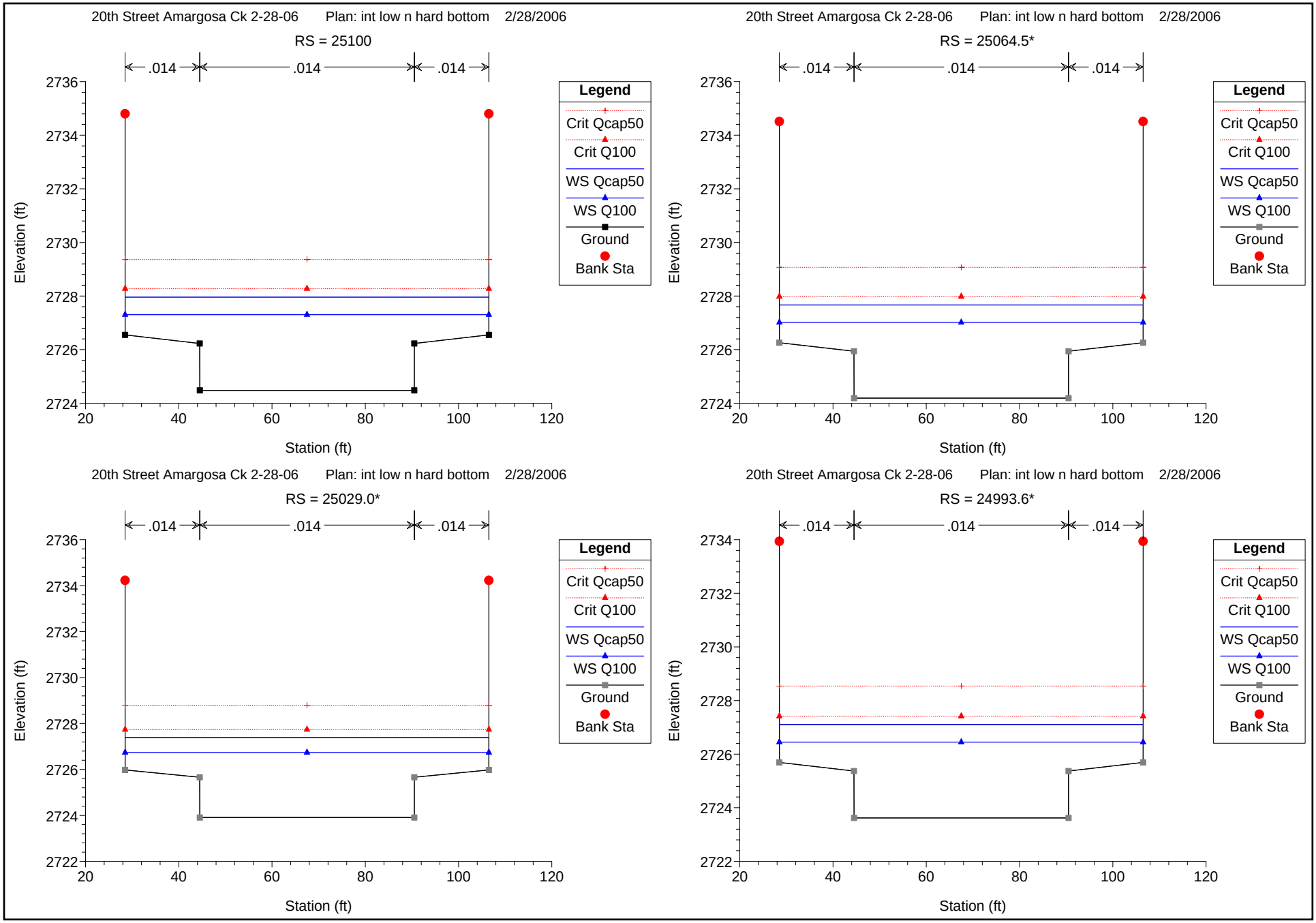
HEC-RAS Plan: int hi n hb River: Amargosa Creek Reach: 1 (Continued)

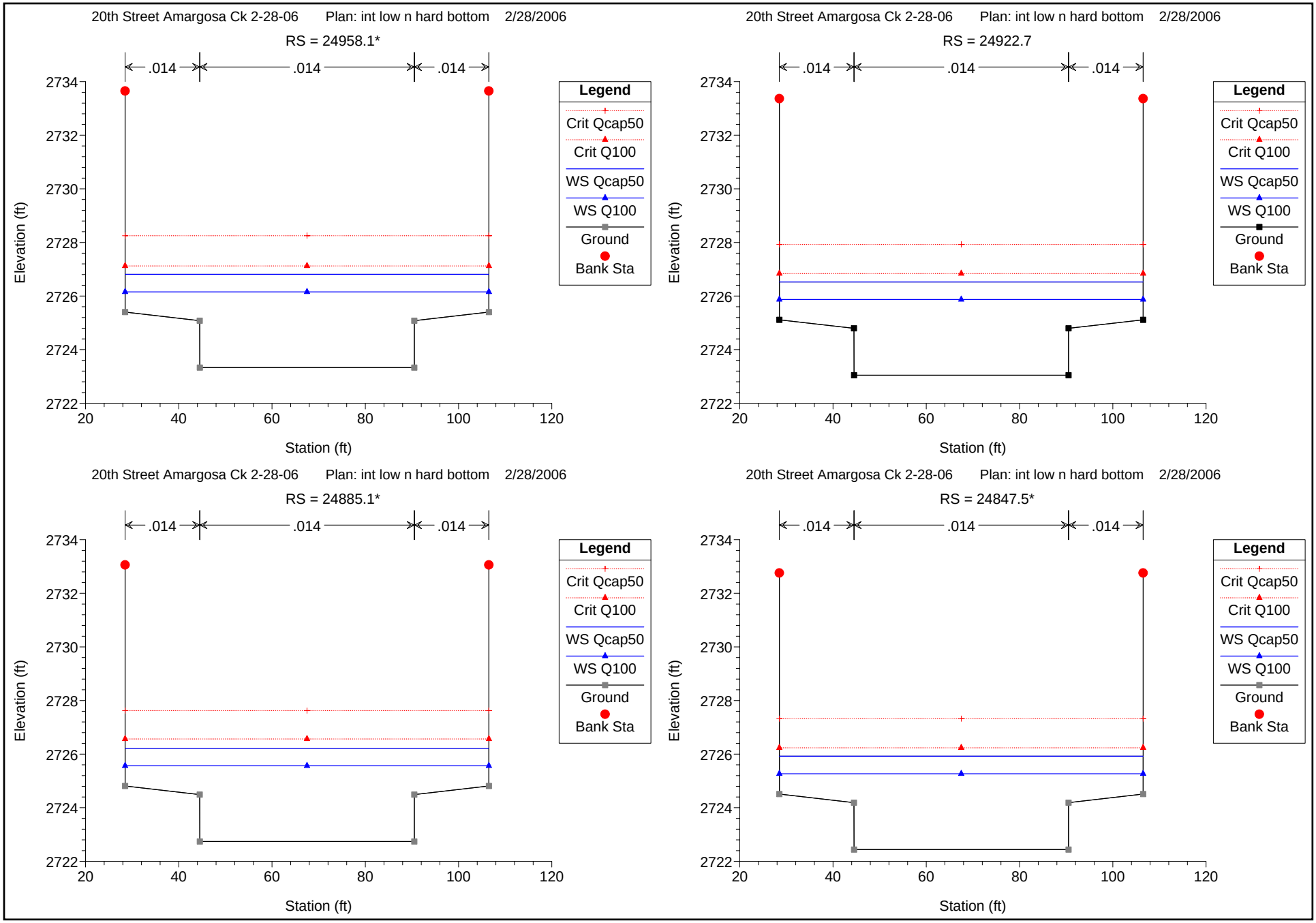
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	24635.0*	Qcap50	3695.00	2720.73	2725.81	2725.81	2728.31	0.010849	12.69	291.20	57.36	0.99
1	24635.0*	Q100	2350.00	2720.73	2724.28	2724.49	2726.35	0.014218	11.54	203.60	57.35	1.08
1	24601.6*	Qcap50	3695.00	2720.47	2725.00	2725.39	2727.85	0.014294	13.56	272.57	60.17	1.12
1	24601.6*	Q100	2350.00	2720.47	2723.90	2724.11	2725.91	0.014428	11.38	206.44	60.17	1.08
1	24568.3	Qcap50	3695.00	2720.20	2724.69	2724.97	2727.34	0.013439	13.07	282.61	63.01	1.09
1	24568.3	Q100	2350.00	2720.20	2723.52	2723.73	2725.48	0.014709	11.25	208.89	63.01	1.09
1	24541.5*	Qcap50	3695.00	2719.99	2723.88	2724.54	2726.87	0.019138	13.87	266.31	70.40	1.26
1	24541.5*	Q100	2350.00	2719.99	2723.02	2723.36	2725.04	0.017724	11.41	205.96	69.51	1.17
1	24514.7*	Qcap50	3695.00	2719.77	2723.50	2724.12	2726.31	0.018825	13.45	274.71	77.45	1.26
1	24514.7*	Q100	2350.00	2719.77	2722.86	2723.02	2724.55	0.014276	10.41	225.81	76.15	1.07
1	24487.9	Qcap50	3695.00	2719.55	2723.27	2723.74	2725.73	0.016588	12.59	293.52	84.62	1.19
1	24487.9	Q100	2350.00	2719.55	2723.07	2722.67	2724.19	0.008120	8.50	276.41	84.00	0.83
1	24450.3*	Qcap50	3695.00	2719.25	2723.83	2723.43	2725.40	0.008164	10.06	367.41	87.27	0.86
1	24450.3*	Q100	2350.00	2719.25	2722.76	2722.36	2723.89	0.008169	8.52	275.94	84.01	0.83
1	24412.7*	Qcap50	3695.00	2718.94	2723.53	2723.10	2725.09	0.008091	10.03	368.49	87.30	0.86
1	24412.7*	Q100	2350.00	2718.94	2722.46	2722.03	2723.58	0.008084	8.49	276.89	84.05	0.82
1	24375.2*	Qcap50	3695.00	2718.64	2723.22	2722.81	2724.78	0.008153	10.05	367.67	87.29	0.86
1	24375.2*	Q100	2350.00	2718.64	2722.15	2721.76	2723.27	0.008150	8.51	276.24	84.06	0.83
1	24337.6*	Qcap50	3695.00	2718.33	2722.92	2722.50	2724.48	0.008083	10.02	368.69	87.31	0.86
1	24337.6*	Q100	2350.00	2718.33	2721.85	2721.43	2722.96	0.008058	8.48	277.25	84.10	0.82
1	24300.1	Qcap50	3695.00	2718.03	2722.61	2722.20	2724.17	0.008103	10.03	368.47	87.32	0.86
1	24300.1	Q100	2350.00	2718.03	2721.54	2721.13	2722.66	0.008115	8.49	276.71	84.11	0.83

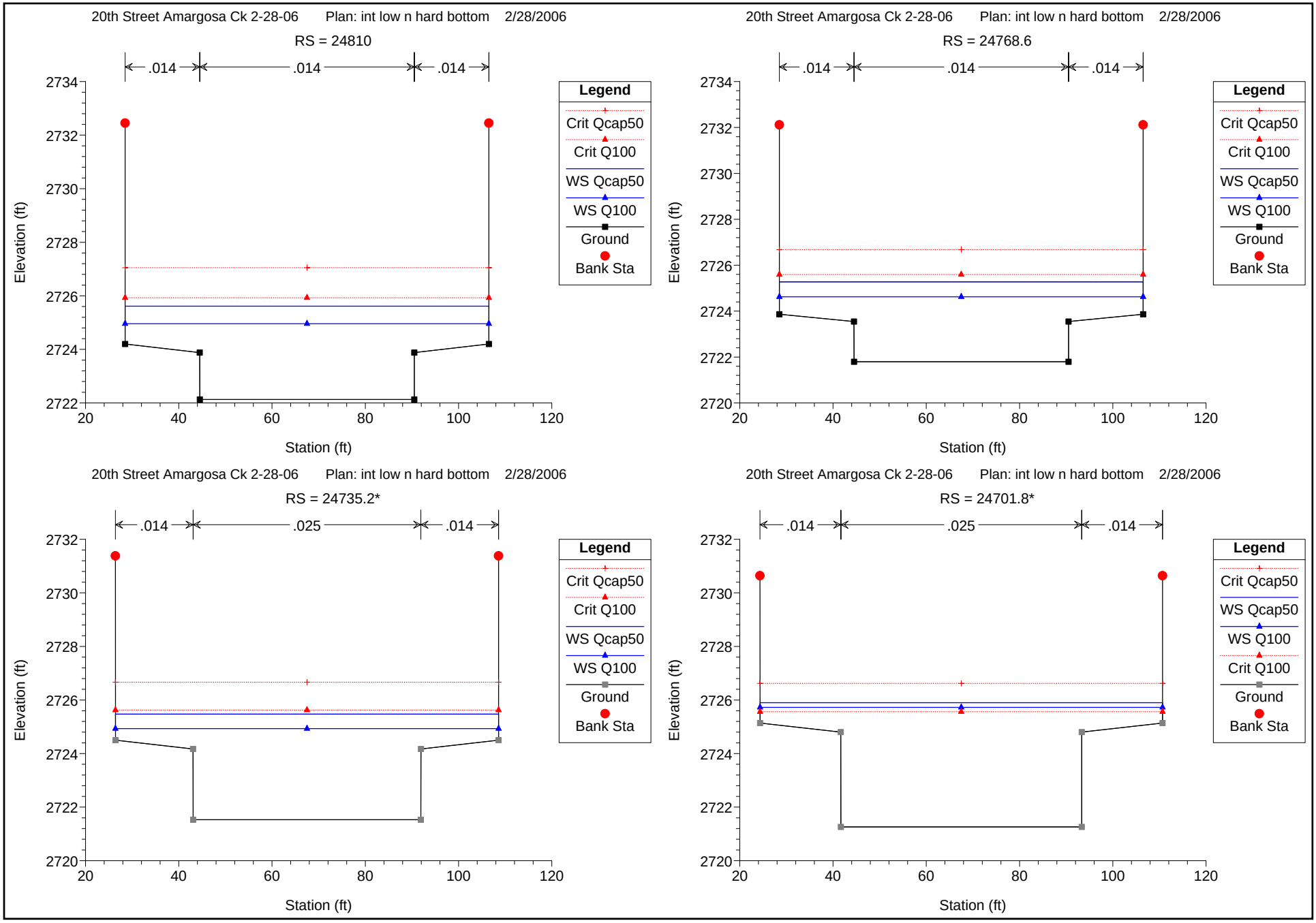
Interim Conditions

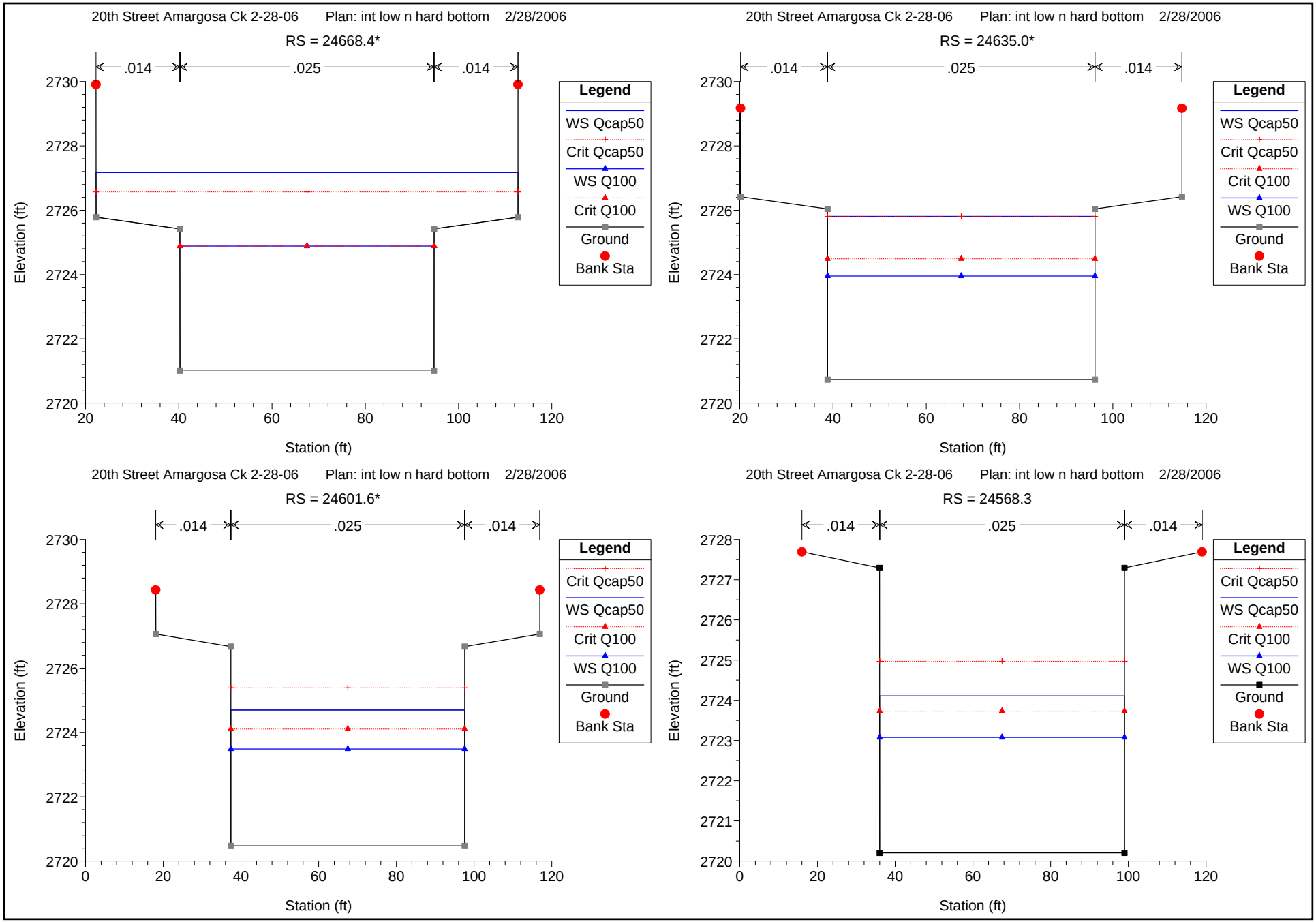
Low Manning's *n*
(for scour evaluation)

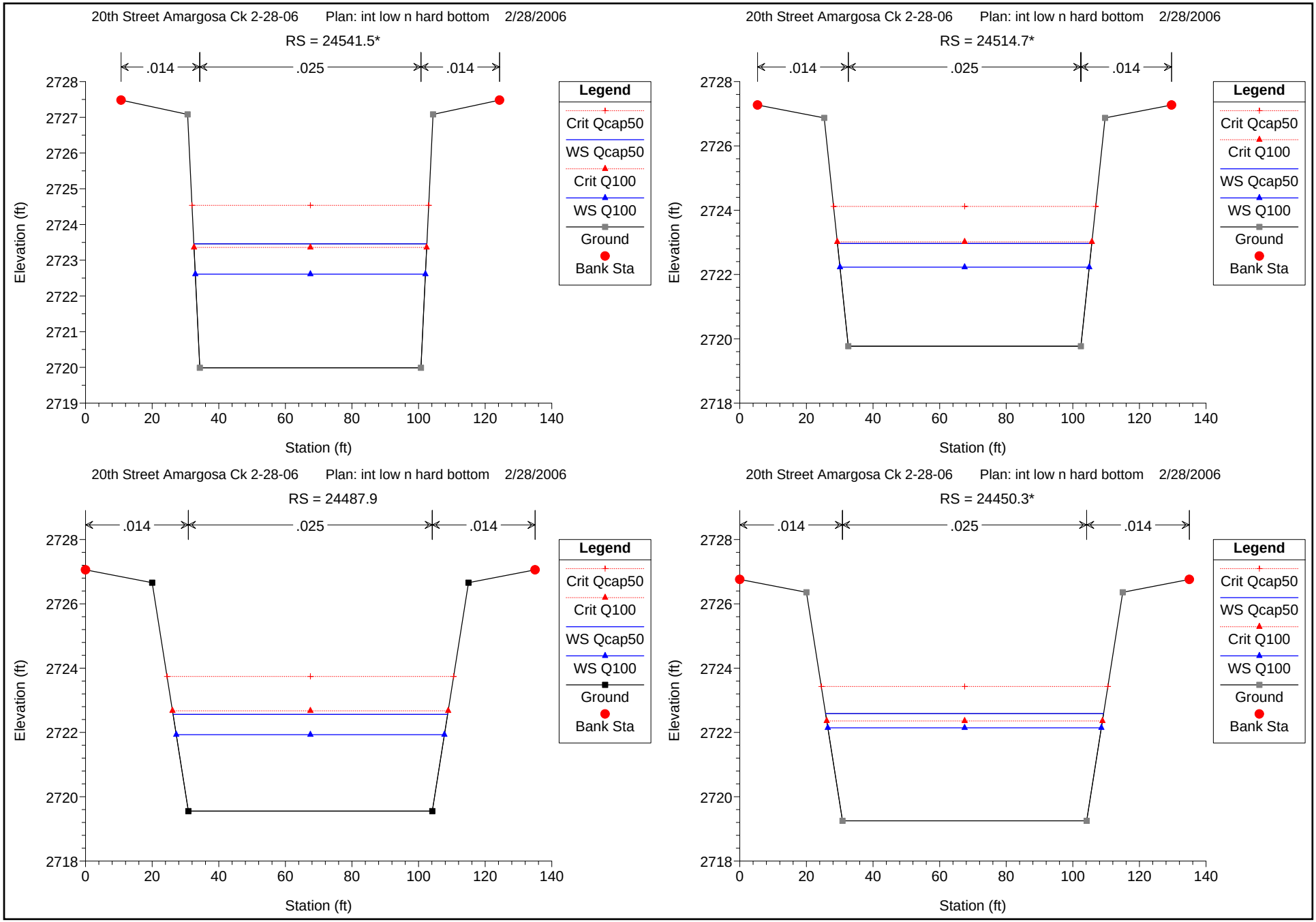

20th Street Amargosa Ck 2-28-06 Plan: int low n hard bottom 2/28/2006
Amargosa Creek 1
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Elevation (ft)
2730
2728
2726
2724
2722
2720
2718
24200
24400
24600
24800
25000
25200
Main Channel Distance (ft)
D/S bridge face
U/S bridge face

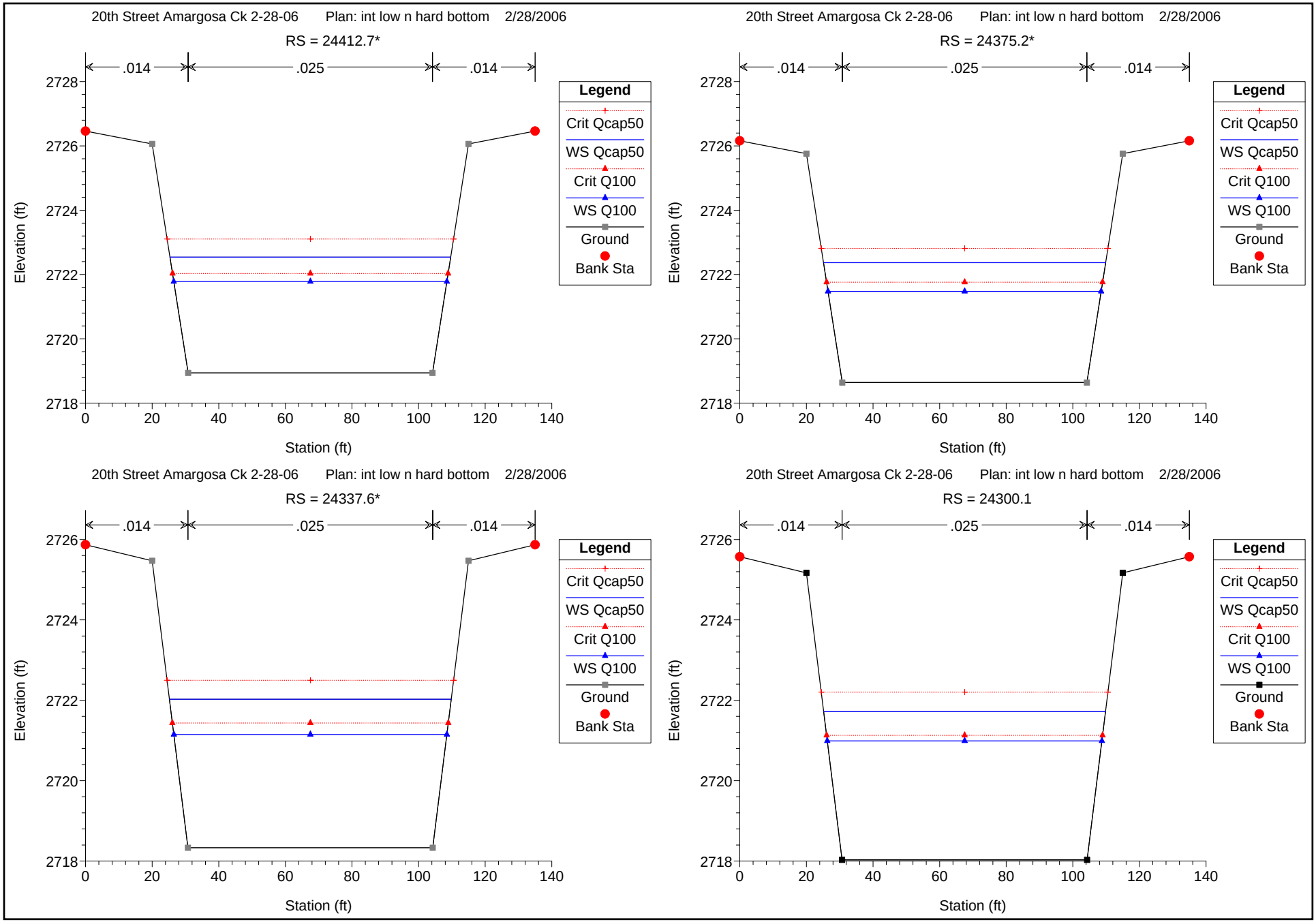

20th Street Amargosa Ck 2-28-06 Plan: int low n hard bottom 2/28/2006
RS = 25100
.014
.014
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
Crit Q100
WS Qcap50
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int low n hard bottom 2/28/2006
RS = 25064.5*
20th Street Amargosa Ck 2-28-06 Plan: int low n hard bottom 2/28/2006
RS = 25029.0*
20th Street Amargosa Ck 2-28-06 Plan: int low n hard bottom 2/28/2006
RS = 24993.6*


20th Street Amargosa Ck 2-28-06 Plan: int low n hard bottom 2/28/2006
RS = 24958.1*
.014
.014
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
Crit Q100
WS Qcap50
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int low n hard bottom 2/28/2006
RS = 24922.7
20th Street Amargosa Ck 2-28-06 Plan: int low n hard bottom 2/28/2006
RS = 24885.1*
20th Street Amargosa Ck 2-28-06 Plan: int low n hard bottom 2/28/2006
RS = 24847.5*


20th Street Amargosa Ck 2-28-06 Plan: int low n hard bottom 2/28/2006
RS = 24810
.014
.014
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
Crit Q100
WS Qcap50
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int low n hard bottom 2/28/2006
RS = 24768.6
.014
.014
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
Crit Q100
WS Qcap50
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int low n hard bottom 2/28/2006
RS = 24735.2*
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
Crit Q100
WS Qcap50
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int low n hard bottom 2/28/2006
RS = 24701.8*
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
WS Q100
Crit Q100
Ground
Bank Sta


20th Street Amargosa Ck 2-28-06 Plan: int low n hard bottom 2/28/2006
RS = 24668.4*
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int low n hard bottom 2/28/2006
RS = 24635.0*
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
WS Qcap50
Crit Qcap50
Crit Q100
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int low n hard bottom 2/28/2006
RS = 24601.6*
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int low n hard bottom 2/28/2006
RS = 24568.3
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta


20th Street Amargosa Ck 2-28-06 Plan: int low n hard bottom 2/28/2006
RS = 24541.5*
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int low n hard bottom 2/28/2006
RS = 24514.7*
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
Crit Q100
WS Qcap50
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int low n hard bottom 2/28/2006
RS = 24487.9
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
Crit Q100
WS Qcap50
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int low n hard bottom 2/28/2006
RS = 24450.3*
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta


20th Street Amargosa Ck 2-28-06 Plan: int low n hard bottom 2/28/2006
RS = 24412.7*
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: int low n hard bottom 2/28/2006
RS = 24375.2*
20th Street Amargosa Ck 2-28-06 Plan: int low n hard bottom 2/28/2006
RS = 24337.6*
20th Street Amargosa Ck 2-28-06 Plan: int low n hard bottom 2/28/2006
RS = 24300.1

HEC-RAS Plan: int lo n hb River: Amargosa Creek Reach: 1

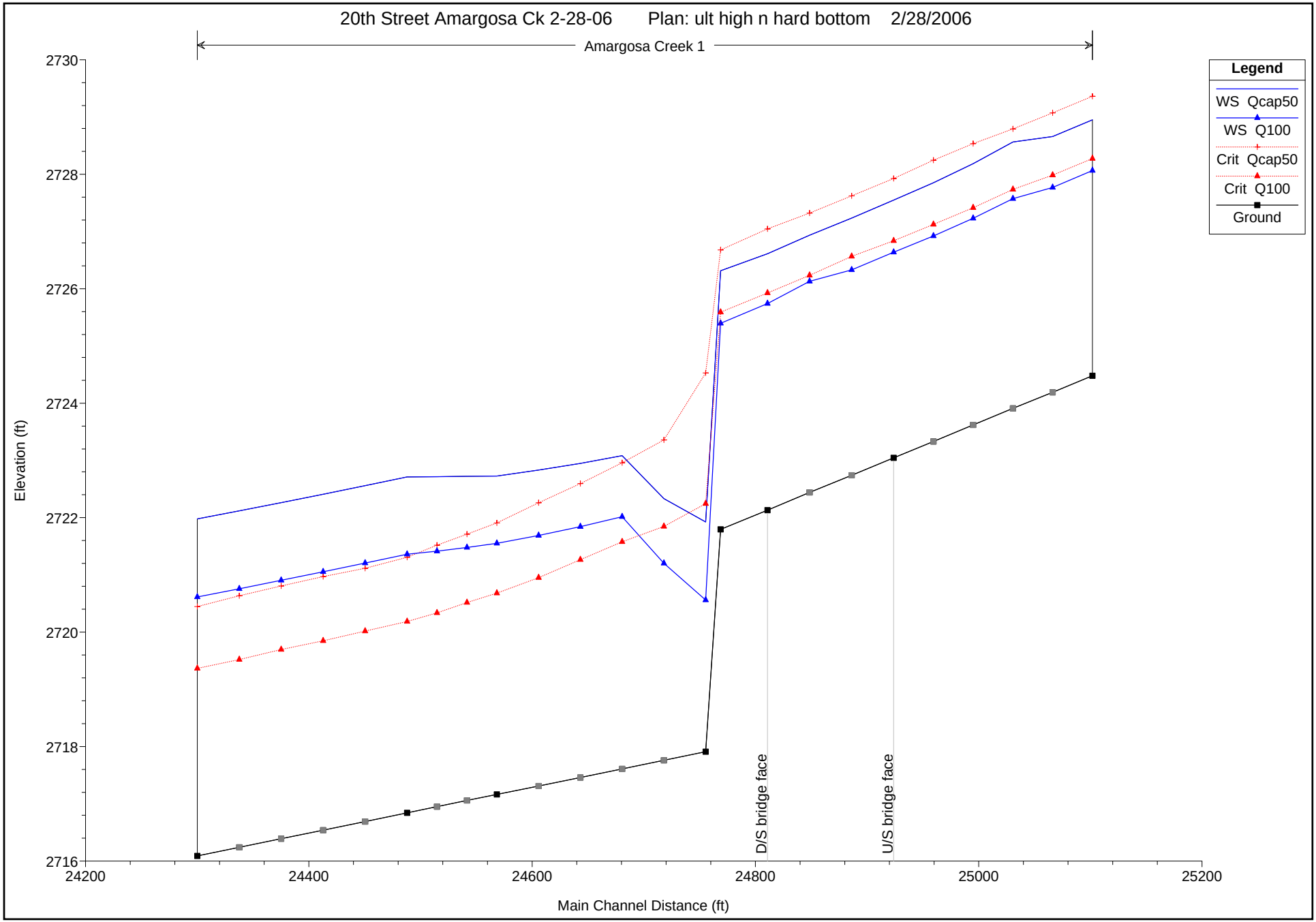
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	25100	Qcap50	3695.00	2724.48	2727.96	2729.36	2732.75	0.008105	17.57	210.26	78.00	1.89
1	25100	Q100	2350.00	2724.48	2727.31	2728.27	2730.69	0.008102	14.75	159.28	78.00	1.82
1	25064.5*	Qcap50	3695.00	2724.19	2727.67	2729.07	2732.47	0.008112	17.58	210.21	78.00	1.89
1	25064.5*	Q100	2350.00	2724.19	2727.01	2727.98	2730.40	0.008114	14.76	159.21	78.00	1.82
1	25029.0*	Qcap50	3695.00	2723.91	2727.39	2728.79	2732.17	0.008067	17.55	210.57	78.00	1.88
1	25029.0*	Q100	2350.00	2723.91	2726.74	2727.74	2730.11	0.008052	14.73	159.59	78.00	1.81
1	24993.6*	Qcap50	3695.00	2723.62	2727.10	2728.54	2731.89	0.008080	17.56	210.46	78.00	1.88
1	24993.6*	Q100	2350.00	2723.62	2726.45	2727.41	2729.82	0.008072	14.74	159.46	78.00	1.82
1	24958.1*	Qcap50	3695.00	2723.33	2726.81	2728.25	2731.60	0.008095	17.57	210.34	78.00	1.89
1	24958.1*	Q100	2350.00	2723.33	2726.16	2727.12	2729.53	0.008091	14.75	159.35	78.00	1.82
1	24922.7	Qcap50	3695.00	2723.04	2726.53	2727.93	2731.31	0.008086	17.56	210.42	78.00	1.88
1	24922.7	Q100	2350.00	2723.04	2725.87	2726.84	2729.25	0.008092	14.75	159.34	78.00	1.82
1	24885.1*	Qcap50	3695.00	2722.74	2726.22	2727.62	2731.01	0.008086	17.56	210.42	78.00	1.88
1	24885.1*	Q100	2350.00	2722.74	2725.57	2726.57	2728.94	0.008092	14.75	159.34	78.00	1.82
1	24847.5*	Qcap50	3695.00	2722.44	2725.92	2727.32	2730.70	0.008067	17.55	210.57	78.00	1.88
1	24847.5*	Q100	2350.00	2722.44	2725.27	2726.23	2728.64	0.008067	14.73	159.49	78.00	1.82
1	24810	Qcap50	3695.00	2722.13	2725.61	2727.05	2730.40	0.008088	17.56	210.40	78.00	1.88
1	24810	Q100	2350.00	2722.13	2724.96	2725.93	2728.34	0.008098	14.75	159.31	78.00	1.82
1	24768.6	Qcap50	3695.00	2721.80	2725.28	2726.68	2730.07	0.008090	17.56	210.38	78.00	1.88
1	24768.6	Q100	2350.00	2721.80	2724.62	2725.59	2728.00	0.008092	14.75	159.34	78.00	1.82
1	24735.2*	Qcap50	3695.00	2721.53	2725.47	2726.67	2729.46	0.013684	16.03	230.48	82.16	1.69
1	24735.2*	Q100	2350.00	2721.53	2724.93	2725.62	2727.41	0.011178	12.62	186.15	82.16	1.48
1	24701.8*	Qcap50	3695.00	2721.26	2725.90	2726.62	2728.77	0.008515	13.58	272.01	86.32	1.35
1	24701.8*	Q100	2350.00	2721.26	2725.73	2725.56	2727.03	0.004147	9.14	257.05	86.32	0.93
1	24668.4*	Qcap50	3695.00	2721.00	2727.17	2726.57	2728.54	0.002729	9.41	392.69	90.49	0.80
1	24668.4*	Q100	2350.00	2721.00	2724.89	2724.89	2726.80	0.006158	11.09	211.85	54.52	0.99

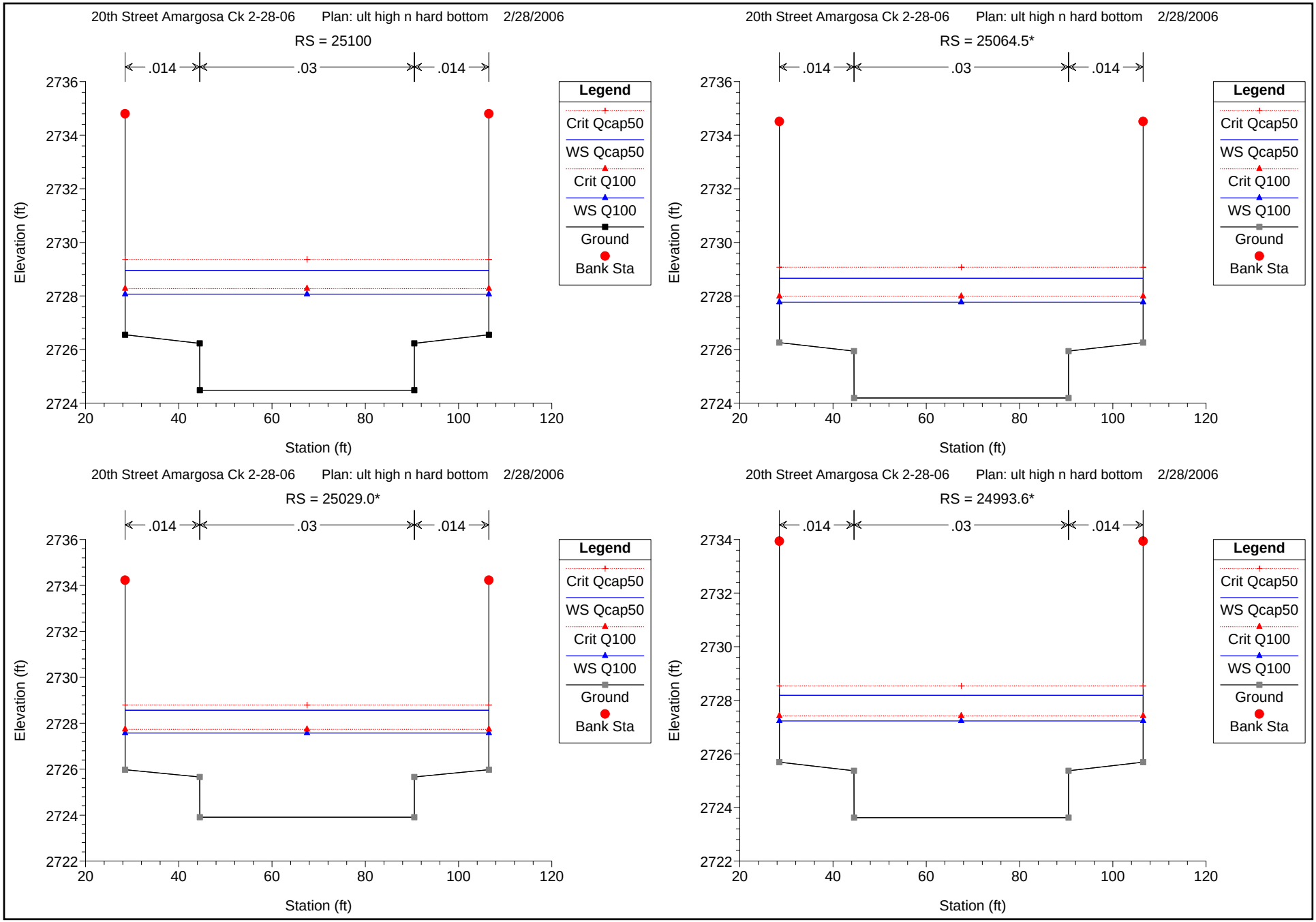
HEC-RAS Plan: int lo n hb River: Amargosa Creek Reach: 1 (Continued)

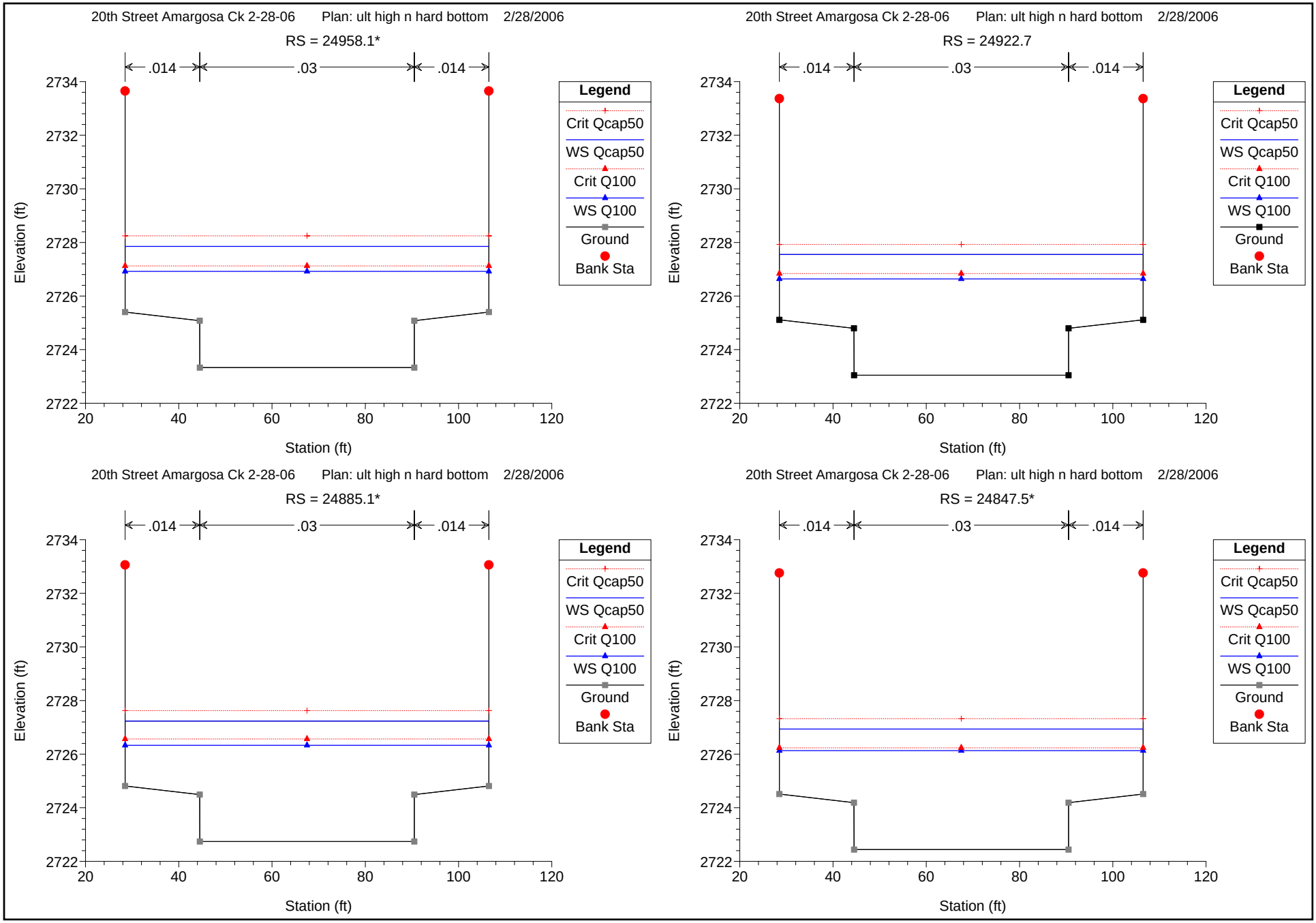
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	24635.0*	Qcap50	3695.00	2720.73	2725.81	2725.81	2728.31	0.005744	12.69	291.20	57.36	0.99
1	24635.0*	Q100	2350.00	2720.73	2723.95	2724.49	2726.46	0.010218	12.71	184.83	57.35	1.25
1	24601.6*	Qcap50	3695.00	2720.47	2724.70	2725.39	2727.98	0.009444	14.53	254.24	60.17	1.25
1	24601.6*	Q100	2350.00	2720.47	2723.49	2724.11	2726.09	0.011519	12.95	181.41	60.17	1.31
1	24568.3	Qcap50	3695.00	2720.20	2724.11	2724.97	2727.61	0.011101	15.02	246.07	63.01	1.34
1	24568.3	Q100	2350.00	2720.20	2723.08	2723.73	2725.69	0.012272	12.98	181.04	63.01	1.35
1	24541.5*	Qcap50	3695.00	2719.99	2723.46	2724.54	2727.25	0.013553	15.63	236.45	69.96	1.50
1	24541.5*	Q100	2350.00	2719.99	2722.61	2723.36	2725.33	0.014019	13.23	177.58	69.09	1.45
1	24514.7*	Qcap50	3695.00	2719.77	2722.96	2724.12	2726.85	0.015231	15.83	233.44	76.35	1.60
1	24514.7*	Q100	2350.00	2719.77	2722.23	2723.02	2724.94	0.014986	13.21	177.94	74.85	1.51
1	24487.9	Qcap50	3695.00	2719.55	2722.56	2723.74	2726.43	0.016210	15.77	234.25	82.45	1.65
1	24487.9	Q100	2350.00	2719.55	2721.93	2722.67	2724.50	0.014762	12.86	182.71	80.51	1.50
1	24450.3*	Qcap50	3695.00	2719.25	2722.59	2723.43	2725.69	0.011348	14.13	261.45	83.48	1.41
1	24450.3*	Q100	2350.00	2719.25	2722.14	2722.36	2723.84	0.007512	10.46	224.75	82.13	1.11
1	24412.7*	Qcap50	3695.00	2718.94	2722.54	2723.10	2725.17	0.008703	13.02	283.76	84.30	1.25
1	24412.7*	Q100	2350.00	2718.94	2721.78	2722.03	2723.54	0.007972	10.65	220.75	82.00	1.14
1	24375.2*	Qcap50	3695.00	2718.64	2722.37	2722.81	2724.81	0.007693	12.53	294.85	84.73	1.18
1	24375.2*	Q100	2350.00	2718.64	2721.48	2721.76	2723.24	0.008023	10.66	220.39	82.03	1.15
1	24337.6*	Qcap50	3695.00	2718.33	2722.03	2722.50	2724.51	0.007931	12.65	292.14	84.63	1.20
1	24337.6*	Q100	2350.00	2718.33	2721.15	2721.43	2722.94	0.008180	10.72	219.13	81.99	1.16
1	24300.1	Qcap50	3695.00	2718.03	2721.72	2722.20	2724.21	0.007986	12.67	291.62	84.64	1.20
1	24300.1	Q100	2350.00	2718.03	2720.99	2721.13	2722.60	0.006901	10.18	230.94	82.46	1.07

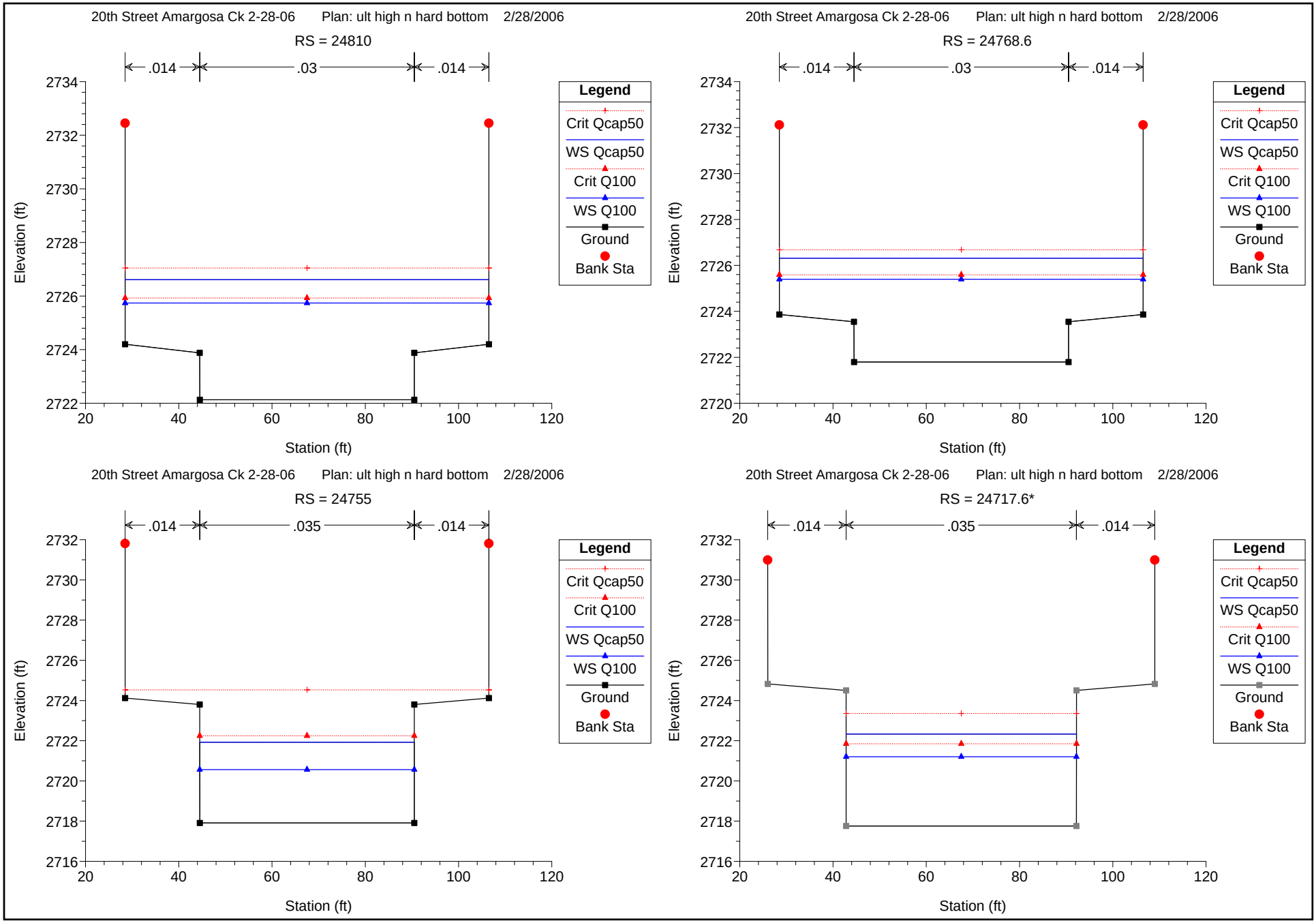
Ultimate Conditions

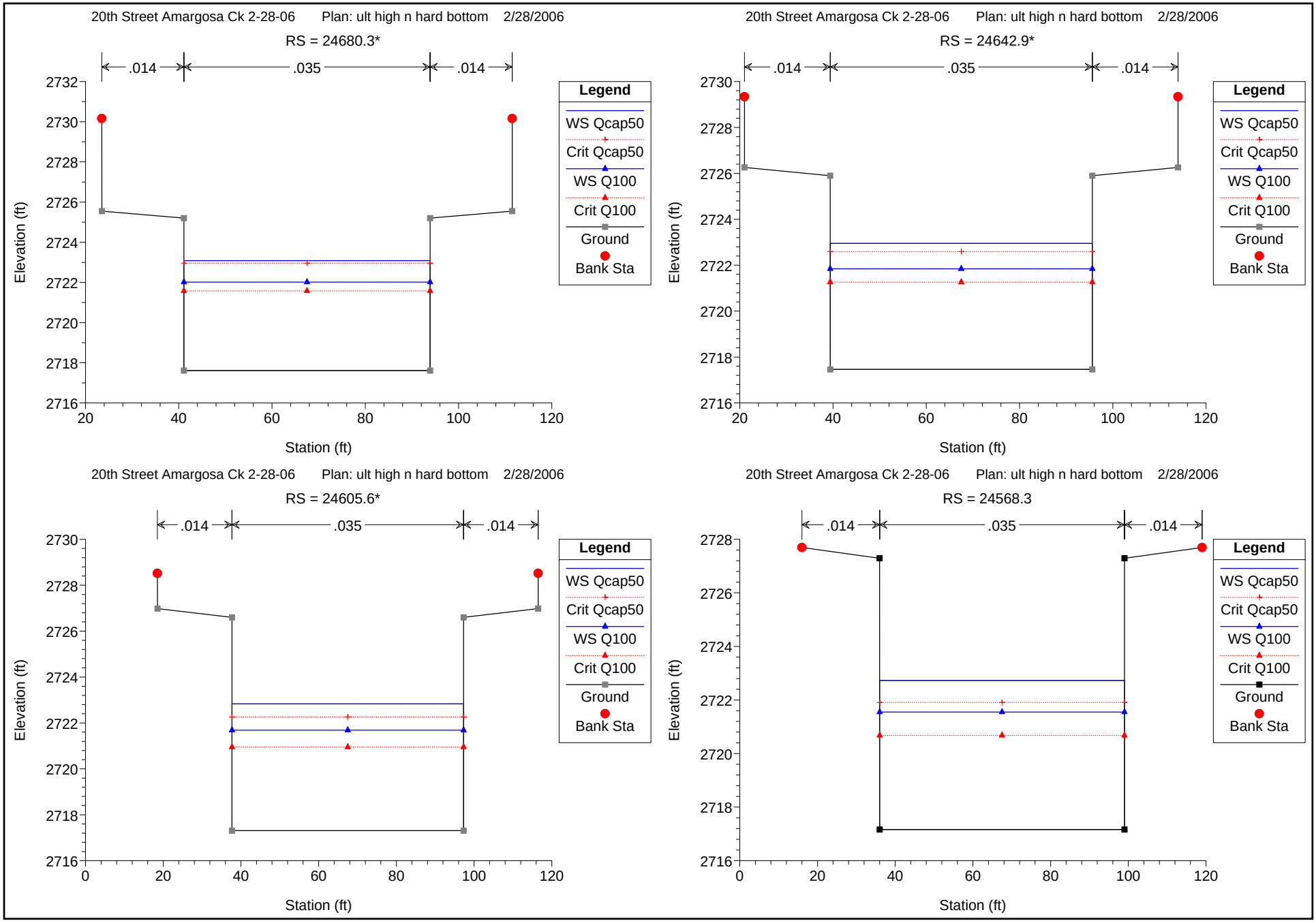
High Manning's *n*
(for freeboard evaluation)

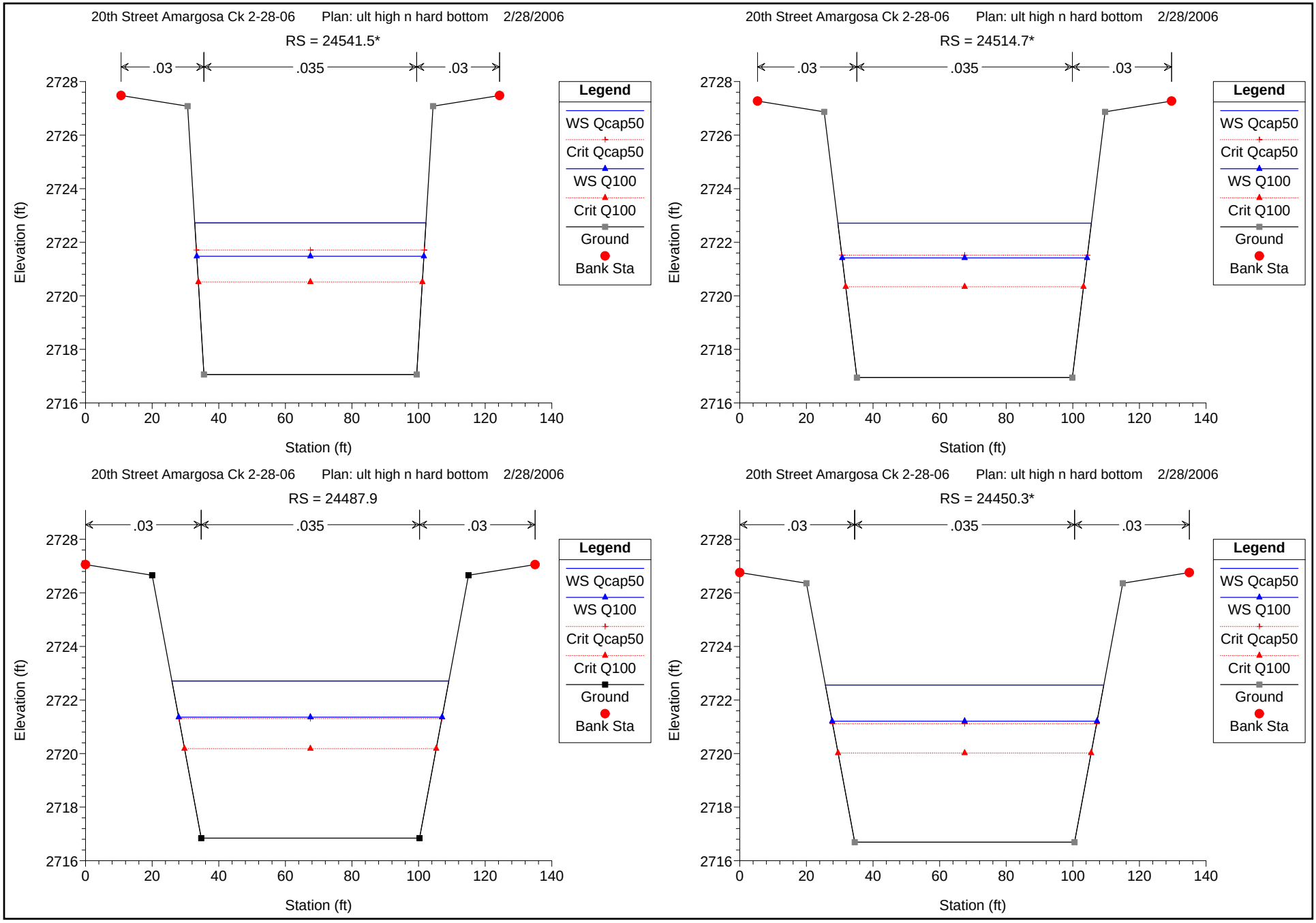

20th Street Amargosa Ck 2-28-06 Plan: ult high n hard bottom 2/28/2006
Amargosa Creek 1
Legend
WS Qcap50
WS Q100
Crit Qcap50
Crit Q100
Ground
Elevation (ft)
2730
2728
2726
2724
2722
2720
2718
2716
24200
24400
24600
24800
25000
25200
Main Channel Distance (ft)
D/S bridge face
U/S bridge face

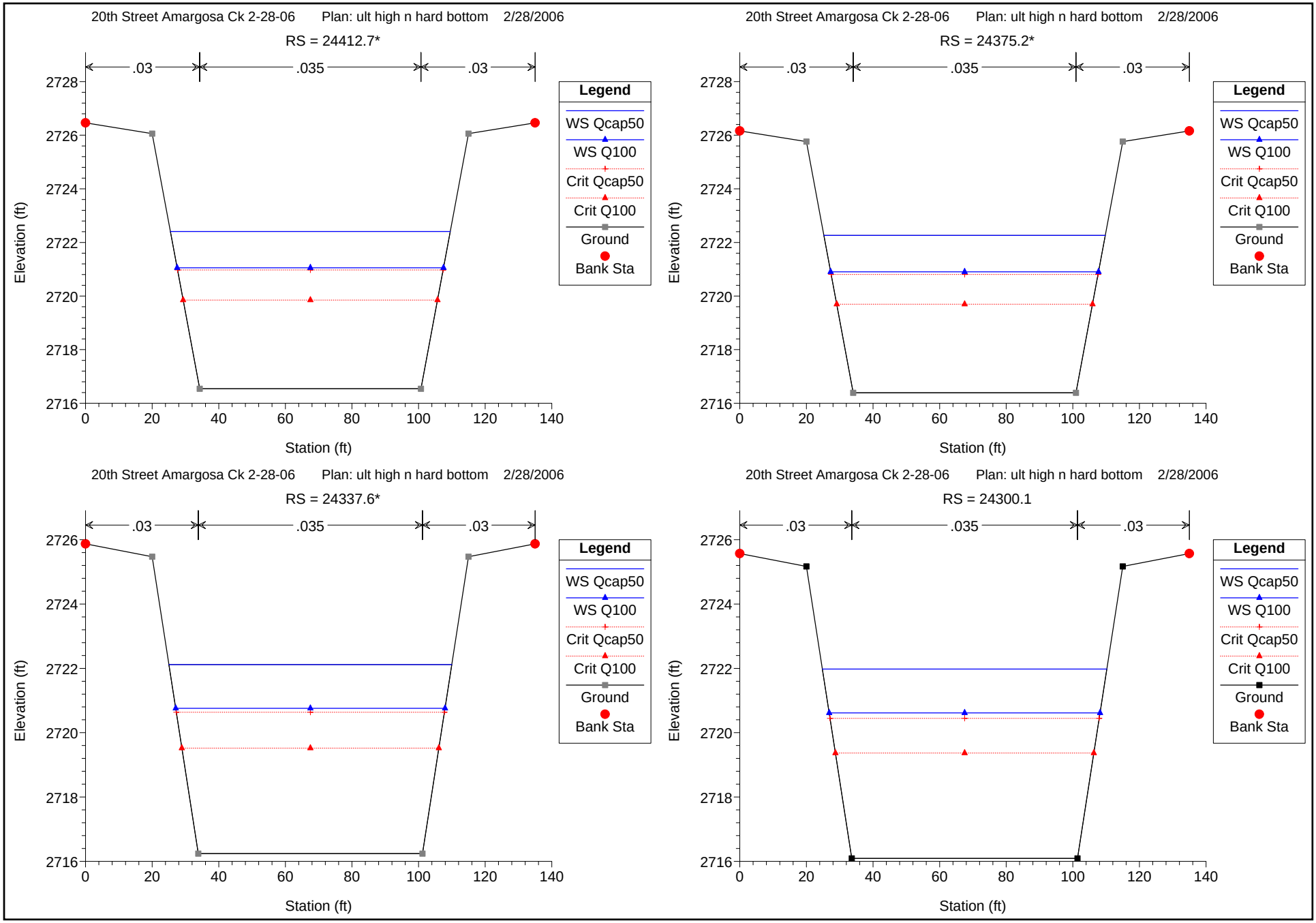

20th Street Amargosa Ck 2-28-06 Plan: ult high n hard bottom 2/28/2006
RS = 25100
.014
.03
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult high n hard bottom 2/28/2006
RS = 25064.5*
20th Street Amargosa Ck 2-28-06 Plan: ult high n hard bottom 2/28/2006
RS = 25029.0*
20th Street Amargosa Ck 2-28-06 Plan: ult high n hard bottom 2/28/2006
RS = 24993.6*


20th Street Amargosa Ck 2-28-06 Plan: ult high n hard bottom 2/28/2006
RS = 24958.1*
.014
.03
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult high n hard bottom 2/28/2006
RS = 24922.7
20th Street Amargosa Ck 2-28-06 Plan: ult high n hard bottom 2/28/2006
RS = 24885.1*
20th Street Amargosa Ck 2-28-06 Plan: ult high n hard bottom 2/28/2006
RS = 24847.5*


20th Street Amargosa Ck 2-28-06 Plan: ult high n hard bottom 2/28/2006
RS = 24810
.014
.03
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult high n hard bottom 2/28/2006
RS = 24768.6
.014
.03
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult high n hard bottom 2/28/2006
RS = 24755
.014
.035
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
Crit Q100
WS Qcap50
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult high n hard bottom 2/28/2006
RS = 24717.6*
.014
.035
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta


20th Street Amargosa Ck 2-28-06 Plan: ult high n hard bottom 2/28/2006
RS = 24680.3*
.014
.035
.014
Elevation (ft)
Station (ft)
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult high n hard bottom 2/28/2006
RS = 24642.9*
.014
.035
.014
Elevation (ft)
Station (ft)
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult high n hard bottom 2/28/2006
RS = 24605.6*
.014
.035
.014
Elevation (ft)
Station (ft)
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult high n hard bottom 2/28/2006
RS = 24568.3
.014
.035
.014
Elevation (ft)
Station (ft)
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Bank Sta


20th Street Amargosa Ck 2-28-06 Plan: ult high n hard bottom 2/28/2006
RS = 24541.5*
.03
.035
.03
Elevation (ft)
Station (ft)
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult high n hard bottom 2/28/2006
RS = 24514.7*
.03
.035
.03
Elevation (ft)
Station (ft)
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult high n hard bottom 2/28/2006
RS = 24487.9
.03
.035
.03
Elevation (ft)
Station (ft)
Legend
WS Qcap50
WS Q100
Crit Qcap50
Crit Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult high n hard bottom 2/28/2006
RS = 24450.3*
.03
.035
.03
Elevation (ft)
Station (ft)
Legend
WS Qcap50
WS Q100
Crit Qcap50
Crit Q100
Ground
Bank Sta


20th Street Amargosa Ck 2-28-06 Plan: ult high n hard bottom 2/28/2006
RS = 24412.7*
.03
.035
.03
Elevation (ft)
Station (ft)
Legend
WS Qcap50
WS Q100
Crit Qcap50
Crit Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult high n hard bottom 2/28/2006
RS = 24375.2*
20th Street Amargosa Ck 2-28-06 Plan: ult high n hard bottom 2/28/2006
RS = 24337.6*
20th Street Amargosa Ck 2-28-06 Plan: ult high n hard bottom 2/28/2006
RS = 24300.1

HEC-RAS Plan: ult hi n hb River: Amargosa Creek Reach: 1

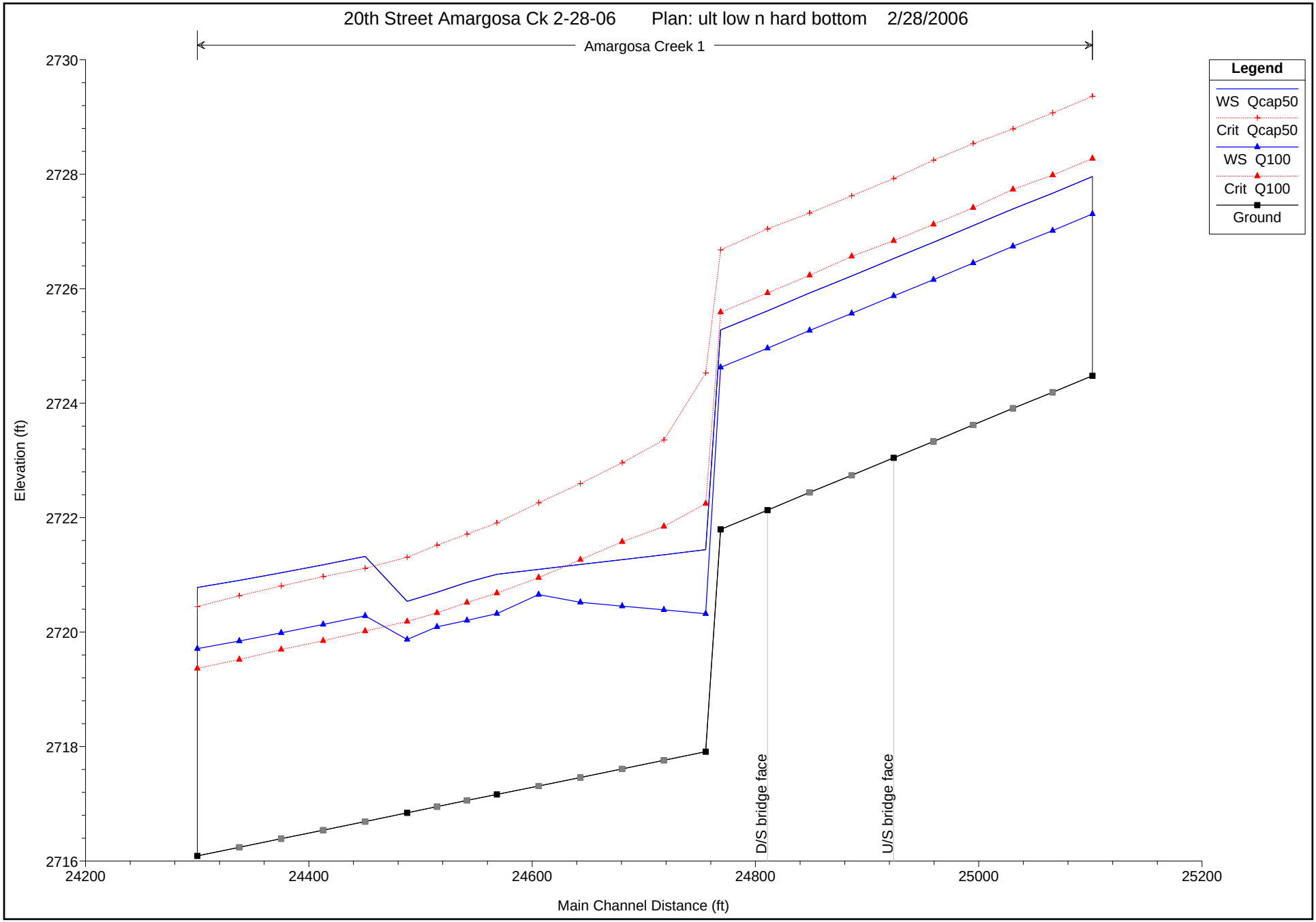
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	25100	Qcap50	3695.00	2724.48	2728.95	2729.36	2731.51	0.008106	12.85	287.66	78.01	1.18
1	25100	Q100	2350.00	2724.48	2728.06	2728.27	2729.86	0.008103	10.76	218.43	78.00	1.13
1	25064.5*	Qcap50	3695.00	2724.19	2728.66	2729.07	2731.22	0.008122	12.85	287.49	78.01	1.18
1	25064.5*	Q100	2350.00	2724.19	2727.77	2727.98	2729.57	0.008141	10.77	218.13	78.00	1.14
1	25029.0*	Qcap50	3695.00	2723.91	2728.56	2728.79	2730.89	0.006914	12.24	301.96	78.01	1.10
1	25029.0*	Q100	2350.00	2723.91	2727.57	2727.73	2729.27	0.007391	10.46	224.62	78.00	1.09
1	24993.6*	Qcap50	3695.00	2723.62	2728.18	2728.54	2730.62	0.007471	12.53	294.90	78.01	1.14
1	24993.6*	Q100	2350.00	2723.62	2727.23	2727.41	2728.99	0.007863	10.66	220.44	78.00	1.12
1	24958.1*	Qcap50	3695.00	2723.33	2727.85	2728.25	2730.35	0.007760	12.68	291.51	78.01	1.16
1	24958.1*	Q100	2350.00	2723.33	2726.92	2727.12	2728.71	0.008034	10.73	219.01	78.00	1.13
1	24922.7	Qcap50	3695.00	2723.04	2727.55	2727.93	2730.07	0.007871	12.73	290.25	78.01	1.16
1	24922.7	Q100	2350.00	2723.04	2726.64	2726.84	2728.42	0.008004	10.72	219.25	78.00	1.13
1	24885.1*	Qcap50	3695.00	2722.74	2727.23	2727.62	2729.77	0.007948	12.77	289.39	78.01	1.17
1	24885.1*	Q100	2350.00	2722.74	2726.33	2726.56	2728.12	0.008054	10.74	218.83	78.00	1.13
1	24847.5*	Qcap50	3695.00	2722.44	2726.94	2727.32	2729.46	0.007932	12.76	289.56	78.01	1.17
1	24847.5*	Q100	2350.00	2722.44	2726.13	2726.23	2727.80	0.007177	10.37	226.64	78.00	1.07
1	24810	Qcap50	3695.00	2722.13	2726.61	2727.05	2729.16	0.008048	12.82	288.29	78.01	1.17
1	24810	Q100	2350.00	2722.13	2725.74	2725.93	2727.51	0.007868	10.66	220.40	78.00	1.12
1	24768.6	Qcap50	3695.00	2721.80	2726.31	2726.68	2728.81	0.007777	12.68	291.32	78.01	1.16
1	24768.6	Q100	2350.00	2721.80	2725.40	2725.59	2727.17	0.007949	10.70	219.71	78.00	1.12
1	24755	Qcap50	3695.00	2717.91	2721.92	2724.53	2728.14	0.036870	20.01	184.68	46.01	1.76
1	24755	Q100	2350.00	2717.91	2720.56	2722.25	2726.33	0.058358	19.27	121.94	46.01	2.09
1	24717.6*	Qcap50	3695.00	2717.76	2722.33	2723.36	2726.49	0.020775	16.35	225.94	49.41	1.35
1	24717.6*	Q100	2350.00	2717.76	2721.20	2721.85	2724.17	0.021350	13.82	170.05	49.41	1.31
1	24680.3*	Qcap50	3695.00	2717.61	2723.08	2722.96	2725.62	0.010060	12.78	289.05	52.81	0.96
1	24680.3*	Q100	2350.00	2717.61	2722.02	2721.58	2723.60	0.008279	10.10	232.66	52.81	0.85

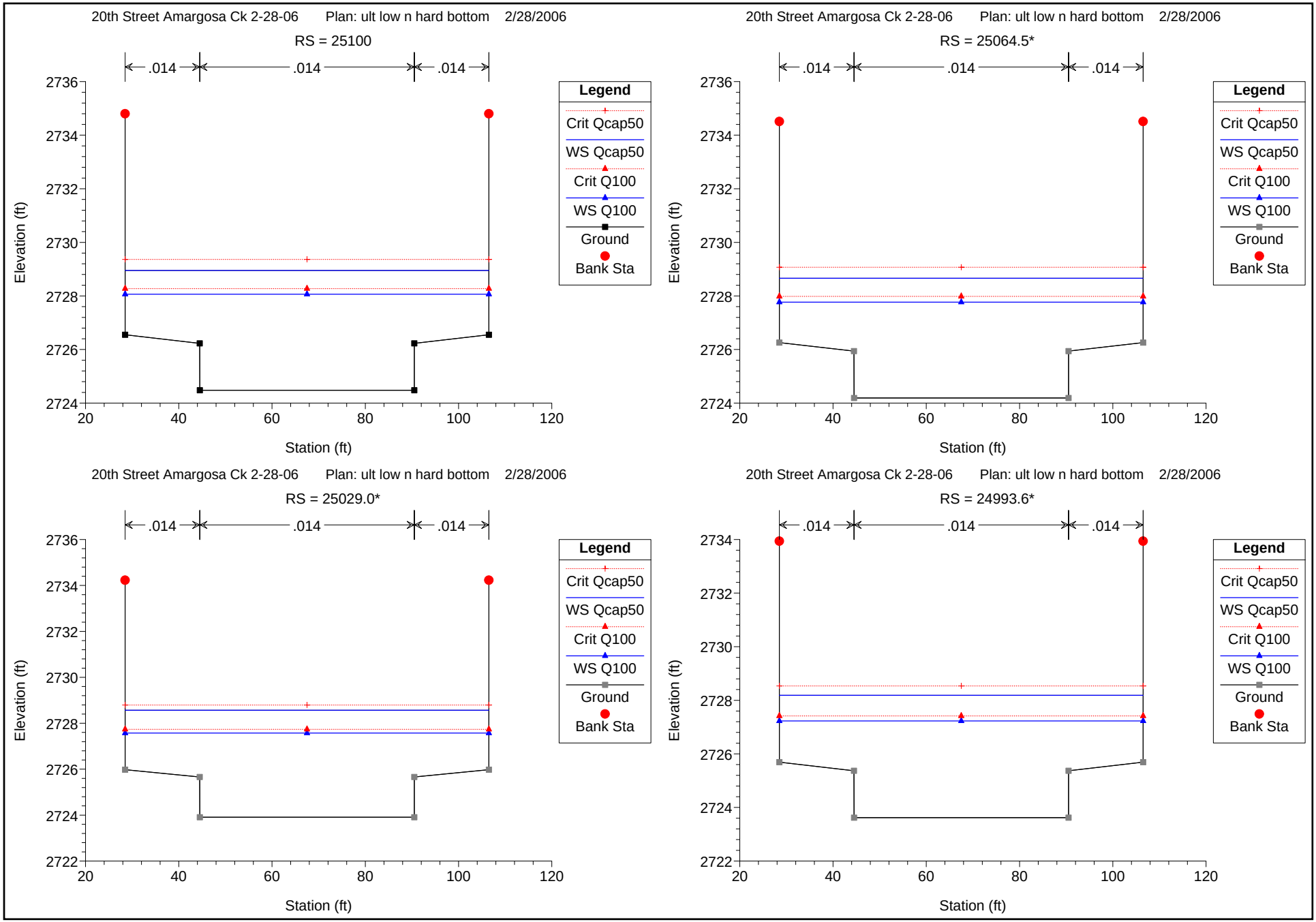
HEC-RAS Plan: ult hi n hb River: Amargosa Creek Reach: 1 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	24642.9*	Qcap50	3695.00	2717.46	2722.95	2722.60	2725.18	0.008766	11.98	308.49	56.21	0.90
1	24642.9*	Q100	2350.00	2717.46	2721.84	2721.27	2723.26	0.007417	9.54	246.28	56.21	0.80
1	24605.6*	Qcap50	3695.00	2717.31	2722.83	2722.26	2724.79	0.007619	11.23	329.08	59.61	0.84
1	24605.6*	Q100	2350.00	2717.31	2721.69	2720.95	2722.95	0.006598	9.01	260.92	59.61	0.76
1	24568.3	Qcap50	3695.00	2717.16	2722.73	2721.91	2724.45	0.006626	10.54	350.56	63.01	0.79
1	24568.3	Q100	2350.00	2717.16	2721.55	2720.68	2722.67	0.005843	8.50	276.47	63.01	0.72
1	24541.5*	Qcap50	3695.00	2717.06	2722.72	2721.71	2724.21	0.006049	9.79	377.31	69.41	0.74
1	24541.5*	Q100	2350.00	2717.06	2721.48	2720.52	2722.49	0.005538	8.05	291.75	68.19	0.69
1	24514.7*	Qcap50	3695.00	2716.95	2722.72	2721.52	2724.00	0.005062	9.10	405.89	76.11	0.69
1	24514.7*	Q100	2350.00	2716.95	2721.42	2720.34	2722.32	0.004851	7.62	308.59	73.54	0.66
1	24487.9	Qcap50	3695.00	2716.84	2722.71	2721.31	2723.82	0.004305	8.47	436.40	83.16	0.65
1	24487.9	Q100	2350.00	2716.84	2721.36	2720.19	2722.16	0.004281	7.19	326.84	79.11	0.62
1	24450.3*	Qcap50	3695.00	2716.69	2722.56	2721.12	2723.66	0.004250	8.42	439.01	83.60	0.65
1	24450.3*	Q100	2350.00	2716.69	2721.21	2720.02	2722.00	0.004232	7.15	328.70	79.55	0.62
1	24412.7*	Qcap50	3695.00	2716.54	2722.41	2720.97	2723.50	0.004197	8.37	441.64	84.05	0.64
1	24412.7*	Q100	2350.00	2716.54	2721.05	2719.85	2721.84	0.004186	7.11	330.51	79.98	0.62
1	24375.2*	Qcap50	3695.00	2716.39	2722.26	2720.81	2723.34	0.004137	8.31	444.50	84.50	0.64
1	24375.2*	Q100	2350.00	2716.39	2720.91	2719.70	2721.68	0.004133	7.07	332.52	80.43	0.61
1	24337.6*	Qcap50	3695.00	2716.24	2722.12	2720.63	2723.18	0.004073	8.26	447.53	84.95	0.63
1	24337.6*	Q100	2350.00	2716.24	2720.76	2719.52	2721.52	0.004073	7.02	334.71	80.87	0.61
1	24300.1	Qcap50	3695.00	2716.09	2721.98	2720.45	2723.02	0.004001	8.19	450.96	85.43	0.63
1	24300.1	Q100	2350.00	2716.09	2720.61	2719.37	2721.37	0.004003	6.97	337.25	81.34	0.60

Ultimate Conditions

Low Manning's *n*
(for scour evaluation)


20th Street Amargosa Ck 2-28-06 Plan: ult low n hard bottom 2/28/2006
Amargosa Creek 1
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Elevation (ft)
2730
2728
2726
2724
2722
2720
2718
2716
24200
24400
24600
24800
25000
25200
Main Channel Distance (ft)
D/S bridge face
U/S bridge face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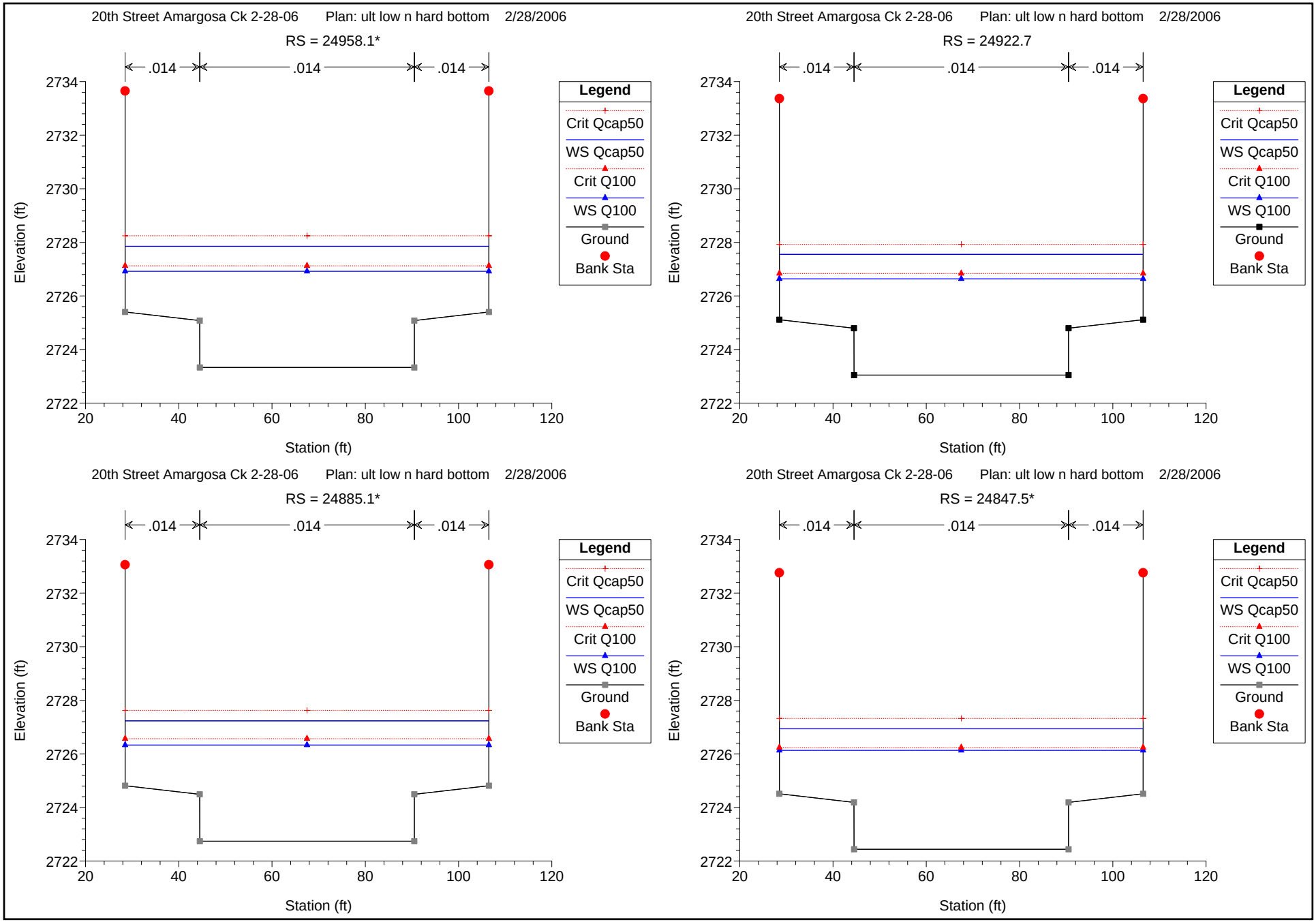
RS = 25100
.014
.014
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult low n hard bottom 2/28/2006
RS = 25064.5*
20th Street Amargosa Ck 2-28-06 Plan: ult low n hard bottom 2/28/2006
RS = 25029.0*
20th Street Amargosa Ck 2-28-06 Plan: ult low n hard bottom 2/28/2006
RS = 24993.6*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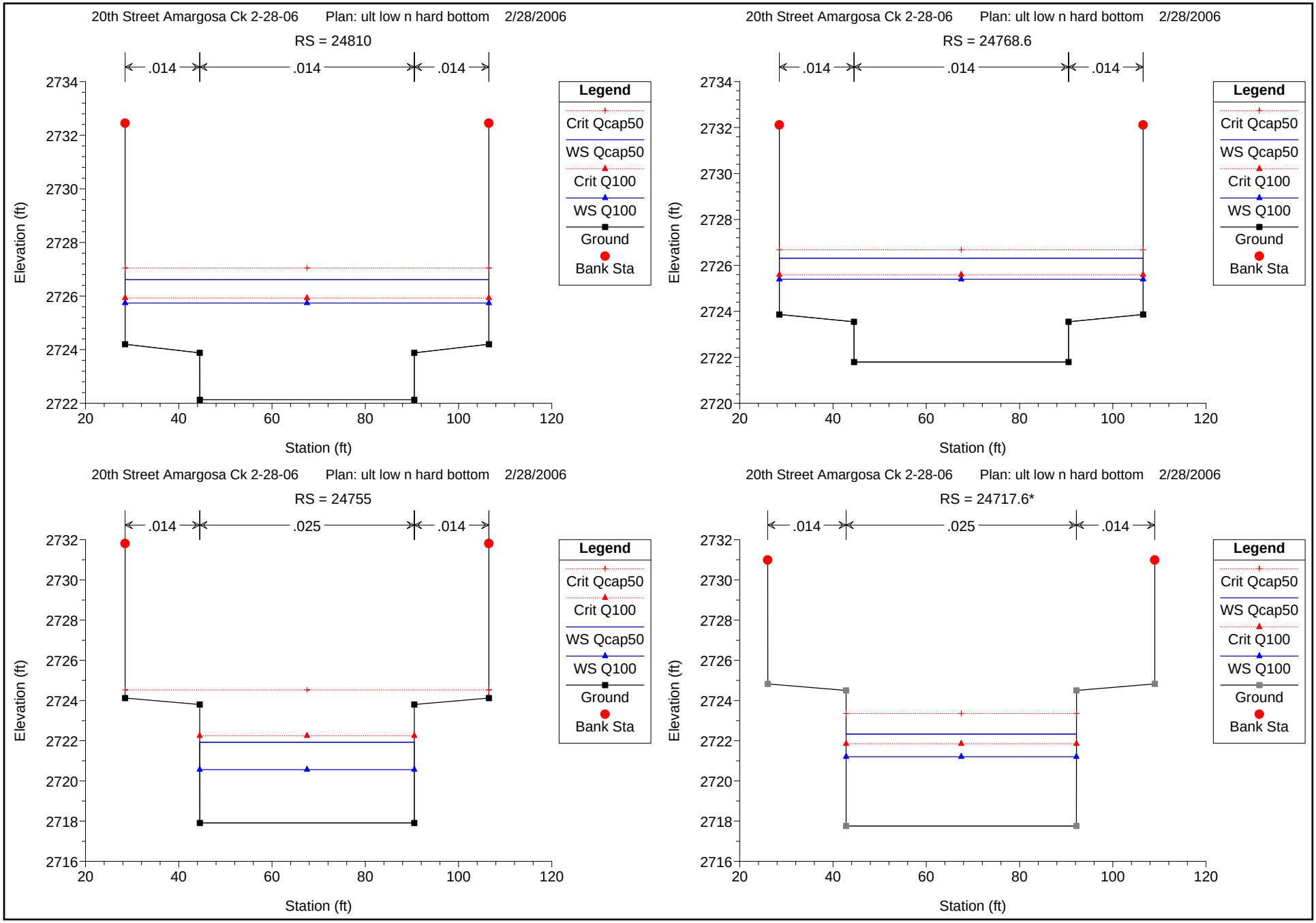
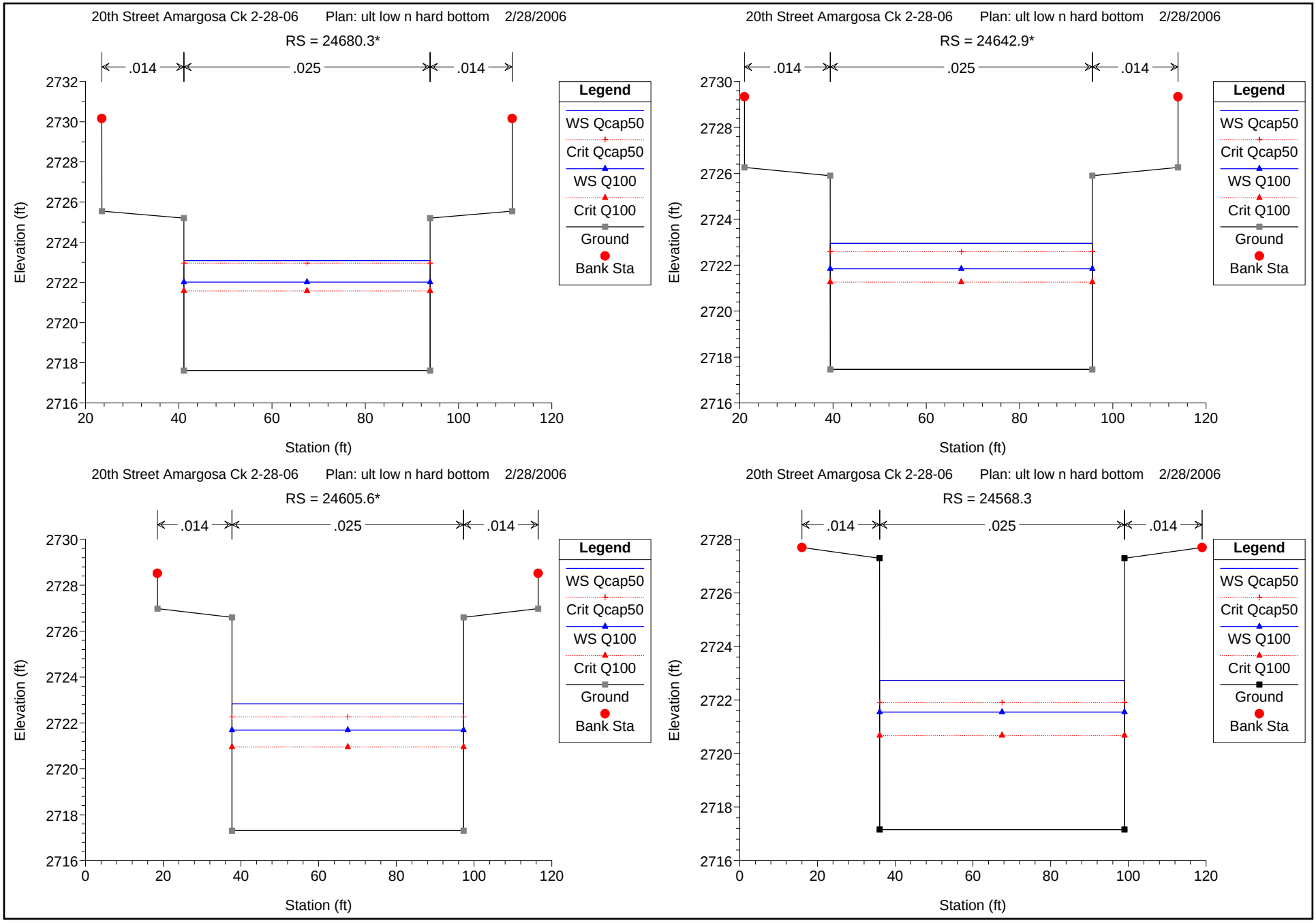
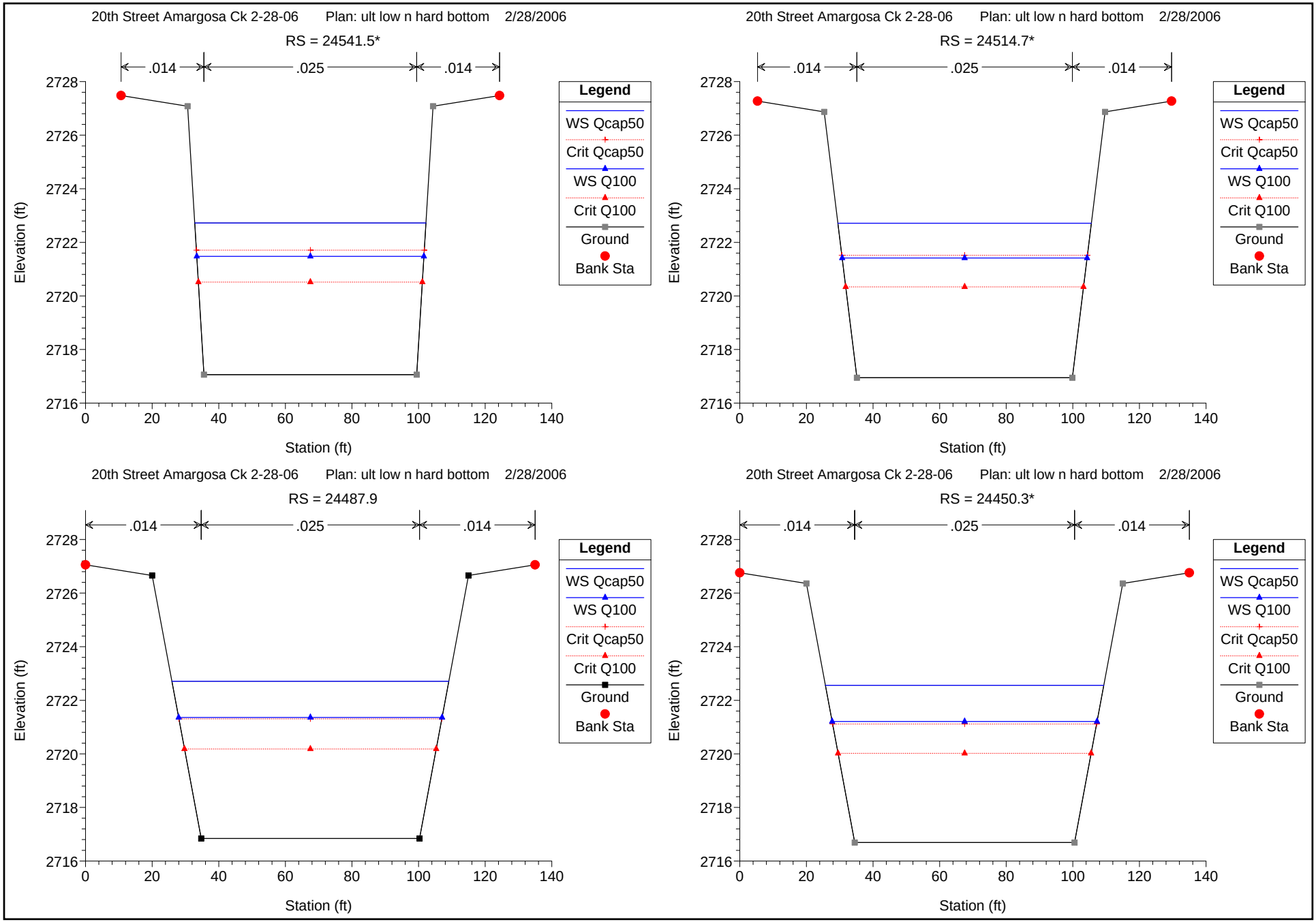
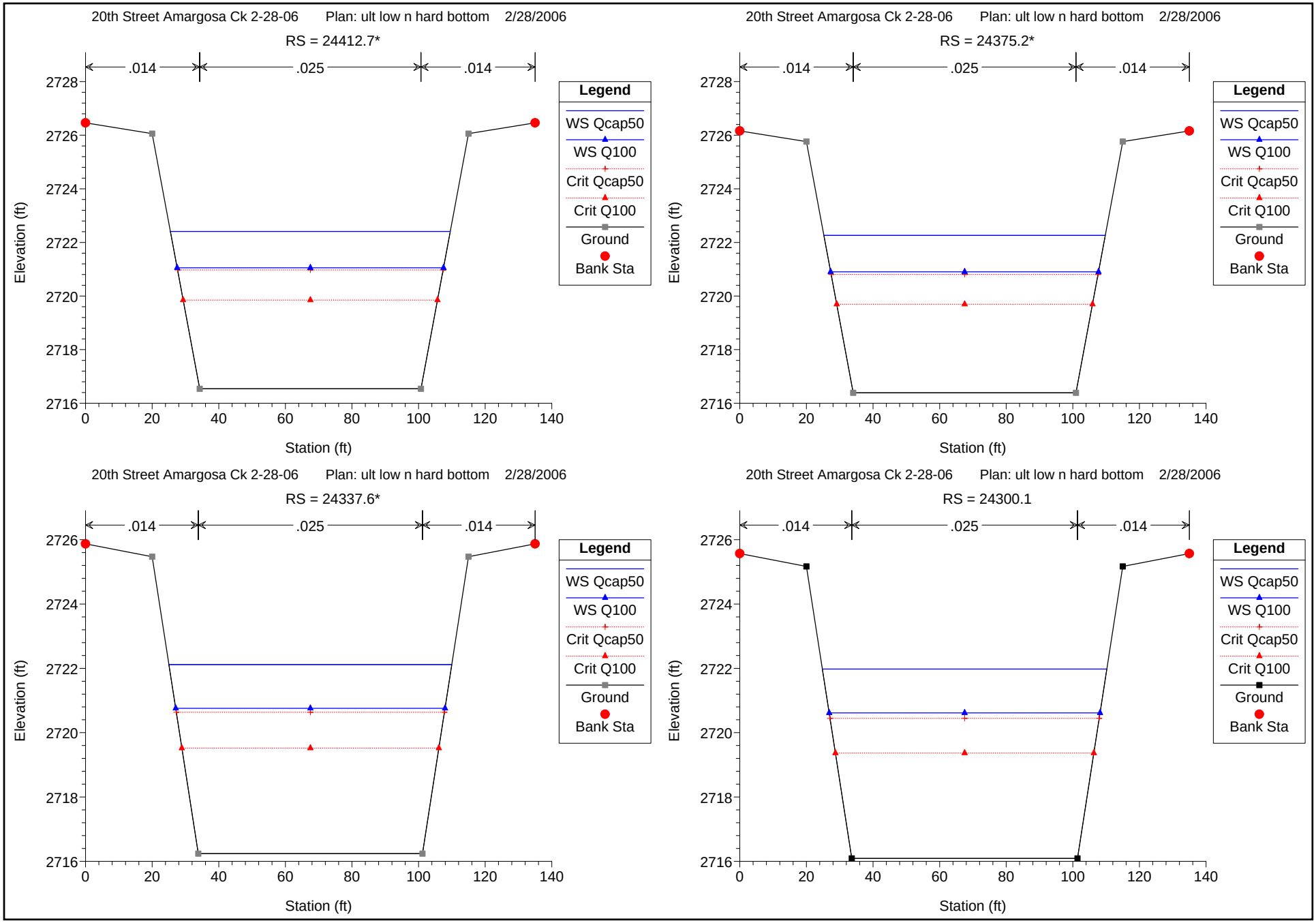
RS = 24958.1*
.014
.014
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult low n hard bottom 2/28/2006
RS = 24922.7
20th Street Amargosa Ck 2-28-06 Plan: ult low n hard bottom 2/28/2006
RS = 24885.1*
20th Street Amargosa Ck 2-28-06 Plan: ult low n hard bottom 2/28/2006
RS = 24847.5*


20th Street Amargosa Ck 2-28-06 Plan: ult low n hard bottom 2/28/2006
RS = 24810
.014
.014
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult low n hard bottom 2/28/2006
RS = 24768.6
.014
.014
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult low n hard bottom 2/28/2006
RS = 24755
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
Crit Q100
WS Qcap50
WS Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult low n hard bottom 2/28/2006
RS = 24717.6*
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
Crit Qcap50
WS Qcap50
Crit Q100
WS Q100
Ground
Bank Sta


20th Street Amargosa Ck 2-28-06 Plan: ult low n hard bottom 2/28/2006
RS = 24680.3*
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult low n hard bottom 2/28/2006
RS = 24642.9*
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult low n hard bottom 2/28/2006
RS = 24605.6*
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult low n hard bottom 2/28/2006
RS = 24568.3
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Bank Sta


20th Street Amargosa Ck 2-28-06 Plan: ult low n hard bottom 2/28/2006
RS = 24541.5*
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
WS Qcap50
Crit Qcap50
WS Q100
Crit Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult low n hard bottom 2/28/2006
RS = 24514.7*
20th Street Amargosa Ck 2-28-06 Plan: ult low n hard bottom 2/28/2006
RS = 24487.9
20th Street Amargosa Ck 2-28-06 Plan: ult low n hard bottom 2/28/2006
RS = 24450.3*


20th Street Amargosa Ck 2-28-06 Plan: ult low n hard bottom 2/28/2006
RS = 24412.7*
.014
.025
.014
Elevation (ft)
Station (ft)
Legend
WS Qcap50
WS Q100
Crit Qcap50
Crit Q100
Ground
Bank Sta
20th Street Amargosa Ck 2-28-06 Plan: ult low n hard bottom 2/28/2006
RS = 24375.2*
20th Street Amargosa Ck 2-28-06 Plan: ult low n hard bottom 2/28/2006
RS = 24337.6*
20th Street Amargosa Ck 2-28-06 Plan: ult low n hard bottom 2/28/2006
RS = 24300.1

HEC-RAS Plan: ult lo n hb River: Amargosa Creek Reach: 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	25100	Qcap50	3695.00	2724.48	2727.96	2729.36	2732.75	0.008105	17.57	210.26	78.00	1.89
1	25100	Q100	2350.00	2724.48	2727.31	2728.27	2730.69	0.008102	14.75	159.28	78.00	1.82
1	25064.5*	Qcap50	3695.00	2724.19	2727.67	2729.07	2732.47	0.008107	17.57	210.25	78.00	1.89
1	25064.5*	Q100	2350.00	2724.19	2727.02	2727.98	2730.40	0.008105	14.76	159.27	78.00	1.82
1	25029.0*	Qcap50	3695.00	2723.91	2727.39	2728.79	2732.17	0.008058	17.54	210.65	78.00	1.88
1	25029.0*	Q100	2350.00	2723.91	2726.74	2727.73	2730.10	0.008026	14.71	159.74	78.00	1.81
1	24993.6*	Qcap50	3695.00	2723.62	2727.10	2728.54	2731.89	0.008069	17.55	210.55	78.00	1.88
1	24993.6*	Q100	2350.00	2723.62	2726.45	2727.41	2729.82	0.008048	14.72	159.61	78.00	1.81
1	24958.1*	Qcap50	3695.00	2723.33	2726.81	2728.25	2731.60	0.008078	17.56	210.48	78.00	1.88
1	24958.1*	Q100	2350.00	2723.33	2726.16	2727.12	2729.53	0.008067	14.73	159.50	78.00	1.82
1	24922.7	Qcap50	3695.00	2723.04	2726.53	2727.93	2731.31	0.008071	17.55	210.53	78.00	1.88
1	24922.7	Q100	2350.00	2723.04	2725.87	2726.84	2729.24	0.008055	14.73	159.57	78.00	1.81
1	24885.1*	Qcap50	3695.00	2722.74	2726.22	2727.62	2731.01	0.008071	17.55	210.53	78.00	1.88
1	24885.1*	Q100	2350.00	2722.74	2725.57	2726.56	2728.94	0.008058	14.73	159.55	78.00	1.81
1	24847.5*	Qcap50	3695.00	2722.44	2725.92	2727.32	2730.70	0.008053	17.54	210.68	78.00	1.88
1	24847.5*	Q100	2350.00	2722.44	2725.27	2726.23	2728.63	0.008032	14.71	159.70	78.00	1.81
1	24810	Qcap50	3695.00	2722.13	2725.61	2727.05	2730.40	0.008073	17.55	210.52	78.00	1.88
1	24810	Q100	2350.00	2722.13	2724.96	2725.93	2728.33	0.008057	14.73	159.56	78.00	1.81
1	24768.6	Qcap50	3695.00	2721.80	2725.28	2726.68	2730.06	0.008055	17.54	210.66	78.00	1.88
1	24768.6	Q100	2350.00	2721.80	2724.63	2725.59	2727.99	0.008036	14.72	159.68	78.00	1.81
1	24755	Qcap50	3695.00	2717.91	2721.44	2724.53	2729.48	0.029620	22.75	162.40	46.01	2.13
1	24755	Q100	2350.00	2717.91	2720.32	2722.25	2727.29	0.041651	21.19	110.89	46.01	2.41
1	24717.6*	Qcap50	3695.00	2717.76	2721.35	2723.36	2728.09	0.024171	20.83	177.38	49.41	1.94
1	24717.6*	Q100	2350.00	2717.76	2720.39	2721.85	2725.47	0.027060	18.09	129.89	49.41	1.97
1	24680.3*	Qcap50	3695.00	2717.61	2721.27	2722.96	2726.96	0.019855	19.14	193.03	52.81	1.76
1	24680.3*	Q100	2350.00	2717.61	2720.45	2721.58	2724.26	0.018254	15.65	150.15	52.81	1.64

HEC-RAS Plan: ult lo n hb River: Amargosa Creek Reach: 1 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	24642.9*	Qcap50	3695.00	2717.46	2721.18	2722.60	2726.03	0.016453	17.66	209.19	56.21	1.61
1	24642.9*	Q100	2350.00	2717.46	2720.52	2721.27	2723.42	0.012624	13.66	171.99	56.21	1.38
1	24605.6*	Qcap50	3695.00	2717.31	2721.10	2722.26	2725.26	0.013780	16.37	225.67	59.61	1.48
1	24605.6*	Q100	2350.00	2717.31	2720.66	2720.95	2722.81	0.008350	11.78	199.43	59.61	1.14
1	24568.3	Qcap50	3695.00	2717.16	2721.01	2721.91	2724.62	0.011667	15.25	242.36	63.01	1.37
1	24568.3	Q100	2350.00	2717.16	2720.32	2720.68	2722.49	0.008983	11.80	199.10	63.01	1.17
1	24541.5*	Qcap50	3695.00	2717.06	2720.87	2721.71	2724.25	0.010729	14.76	250.31	67.59	1.35
1	24541.5*	Q100	2350.00	2717.06	2720.20	2720.52	2722.23	0.008258	11.43	205.61	66.94	1.15
1	24514.7*	Qcap50	3695.00	2716.95	2720.70	2721.52	2723.92	0.010251	14.42	256.30	72.12	1.35
1	24514.7*	Q100	2350.00	2716.95	2720.09	2720.34	2721.98	0.007576	11.03	213.01	70.92	1.12
1	24487.9	Qcap50	3695.00	2716.84	2720.54	2721.31	2723.61	0.009808	14.06	262.73	76.64	1.34
1	24487.9	Q100	2350.00	2716.84	2719.87	2720.19	2721.77	0.007916	11.07	212.33	74.64	1.16
1	24450.3*	Qcap50	3695.00	2716.69	2721.32	2721.12	2723.18	0.004386	10.93	337.93	79.89	0.94
1	24450.3*	Q100	2350.00	2716.69	2720.29	2720.02	2721.59	0.004313	9.16	256.65	76.78	0.88
1	24412.7*	Qcap50	3695.00	2716.54	2721.18	2720.97	2723.01	0.004322	10.86	340.27	80.35	0.93
1	24412.7*	Q100	2350.00	2716.54	2720.13	2719.85	2721.42	0.004266	9.10	258.12	77.22	0.88
1	24375.2*	Qcap50	3695.00	2716.39	2721.04	2720.81	2722.84	0.004236	10.77	343.17	80.82	0.92
1	24375.2*	Q100	2350.00	2716.39	2719.99	2719.70	2721.26	0.004199	9.04	259.99	77.68	0.87
1	24337.6*	Qcap50	3695.00	2716.24	2720.90	2720.63	2722.67	0.004135	10.66	346.52	81.30	0.91
1	24337.6*	Q100	2350.00	2716.24	2719.85	2719.52	2721.09	0.004116	8.96	262.19	78.13	0.86
1	24300.1	Qcap50	3695.00	2716.09	2720.78	2720.45	2722.50	0.004006	10.53	350.75	81.83	0.90
1	24300.1	Q100	2350.00	2716.09	2719.71	2719.37	2720.93	0.004003	8.86	265.09	78.63	0.85

Attachment L

Geotechnical Investigation Report

GEOTECHNICAL INVESTIGATION
PROPOSED BRIDGE
20 TH STREET WEST AT
AMARGOSA CREEK IMPROVEMENTS
CITY OF PALMDALE, CALIFORNIA

Submitted to
City of Palmdale

Prepared for

Lim and Nascimento Engineering
12-L Mauchly
Irvine, CA 92618

Prepared by

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GDC Project No. I-380
March 24, 2006

GROUP DELTA CONSULTANTS

Certified MBE

Geotechnical Engineering
Geology
Hydrogeology
Earthquake Engineering
Materials Testing & Inspection
Forensic Services

March 24, 2006

Lim and Nascimento Engineering
12-L Mauchly
Irvine, CA 92618

Attention: Mr. James Faber

Subject: Geotechnical Investigation
Proposed Bridge
20th Street West at Amargosa Creek Improvements
City of Palmdale, California
Group Delta Consultants Project No. I-380

Dear James:

We have completed our geotechnical investigation for the 29th Street West at Amargosa Improvement Project and we are pleased to present the accompanying Geotechnical Investigation Report. Our investigation was performed in general accordance with our Proposal No. I05-003 dated January 18, 2005.

We appreciate the opportunity to be on your design team for this important project. Should you have any questions, please call us at (949) 609-1020.

Very truly yours,
GROUP DELTA CONSULTANTS, INC.

DRAFT **DRAFT**

Vesna Glisic.
Project Engineer

Kul Bhushan, Ph.D., G.E.
President

Distribution: Addressee (1 Electronic copy)

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GEOTECHNICAL INVESTIGATION
PROPOSED BRIDGE
20TH STREET WEST AT
AMARGOSA CREEK IMPROVEMENTS
CITY OF PALMDALE, CALIFORNIA

1.0 INTRODUCTION

1.1 Project Description

The project will include construction of a new overcrossing where the proposed extension of 20th Street will cross over Amargosa Creek. The width of the channel at the location of the proposed overcrossing is about 140 ft and a single span bridge will be constructed at the site. In addition, the project will include construction of roadway improvements along 20th Street West between Elizabeth Lake Road and Avenue P-8. The site location is shown in the Vicinity Map, Figure 1. An aerial view of the site is shown in Figure 2.

The proposed creek crossing will be a single span bridge which is a cast-in-place pre-stressed box-girder concrete structure supported by two abutments on the ends (Figure 3a and 3b). The bridge will carry four lanes of traffic with a shoulder and a side walk on each side. The bridge will extend from station 16+95.89 to 18+15.97 of the 20th Street alignment with a length of 120.08 feet and a width of 80.0 feet. The deck elevation of the bridge will range from El. 2738.78 feet at Abutment 2 to El. 2740.82 feet at Abutment 1. Concrete bicycle and pedestrian trails with a width of 16 feet are proposed between the channel and the abutments along the creek banks. Two options for the bridge are being considered. Alternative 1 Figure 3a will be a lined channel and Alternative 2 will be an unlined channel where Caltrans Standard Retaining Walls (Type I) will be used on both sides to support the trails.

The geotechnical investigation for the overcrossing structure and along the roadway improvements was performed in general accordance with Caltrans procedures and the bridge will be designed using Caltrans Standard Bridge design methods.

1.2 Purpose and Scope of Work

The purpose of this investigation was to evaluate the physical and engineering properties of the subsurface soils encountered in field explorations, and to provide geotechnical recommendations for foundation support for the proposed bridge and the roadway.

Specifically, our scope of work included:

- Review existing topography and published geologic and seismic reports;
- Drill four geotechnical soil borings along the alignment for the purpose of structure foundation and roadway design (see Appendix A);
- Perform laboratory testing of soil samples (see Appendix B);
- Perform engineering analyses to develop geotechnical recommendations for site grading, structural backfill, and foundation support; and
- Present the data and our recommendations in this report.

2.0 FIELD EXPLORATION AND LABORATORY TESTING

2.1 Field Exploration

Group Delta Consultants, Inc. (GDC) investigated the subsurface conditions at the project site on November 16, and 17, 2005 by performing four borings to depths ranging from 26.5 to 81.5 feet. The boring location map is provided in Figure 4. Field data and the details of the investigation are presented in Appendix A.

2.2 Laboratory Testing

Laboratory tests were performed on representative samples to characterize the soils and to develop indices and engineering properties of the soils. Laboratory tests performed consisted of:

- In situ moisture content and dry density,
- Percent Passing No. 200 Sieve,
- Corrosivity tests (pH, sulfates, chlorides, and electrical resistivity),
- Collapse potential test (ASTM D5333),
- R-value tests.

Descriptions of laboratory testing program and test results are provided in Appendix B.

3.0 SITE CONDITIONS

3.1 Regional Geology and Seismicity

The site is within the Mojave Geomorphic Province near the northern transition with the Transverse Range Geomorphic Province of California. Large Quaternary filled sedimentary basins, forming piedmont and alluvium slopes, are present along bounding mountains of older crystalline and sedimentary rock. The dominant geologic structure in the area is the San Andreas Fault that is about 1500 feet south of the site. The San Andreas Fault separates the Mojave Geomorphic Province to the north from the Transverse Range Geomorphic Province to the south.

The site is within a large alluvial fan that descends in a northerly direction. The upper portion of the alluvium sediments may consist of a loose to medium dense silty sand to sand. Where the bridge crosses the Amargosa Creek, there are sand to silty sand elevated terrace deposits with sandy to gravelly stream channel deposits along the creek bottom. The terrace deposits indicate that the area is undergoing gradual uplift, which may be due to movement on the nearby San Andreas Fault.

Nearby basement rock to the south consists of the Holcomb Quartz Monzonite and Granodiorite and Portal Schist. The Holcomb series of igneous rock is medium- to coarse grained which weathers to a buff color. The Portal Schist is a dark metamorphic rock with some gneiss and quartzite zones. The depth of the basement rocks is unknown at the bridge location.

3.2 Topography and Drainage

The project area has grades ranging from about El. 2,760 ft at the southern end of the project near Elizabeth Lake Road and about El. 2,720 ft near northern end of the project near intersection of 20th street and Avenue P-8. The area is relatively flat with drainage towards northeast at an approximate 2% grade.

3.3 Subsurface Conditions

3.3.1 Soil Conditions

The subsurface conditions at the project site generally consist of alluvial soils associated with Amargosa Creek. A generalized soil profile is shown in Figure 5. The soils primarily consist of loose to medium dense silty and clayey sands and medium dense sandy silts to depths of 10 to 15 feet. The SPT blow counts range between 4 and 29 with an average of 17 and the percent passing No. 200 sieve for

sand is 11%. The natural moisture content ranges between 1.5% and 17% and the dry density ranges between 105 and 118 pcf.

These soils are underlain by dense to very dense sands and silty sands except for a 5 feet layer of very dense sandy silt occurring at a depth of about 55 feet in Boring B-3. The SPT blow counts of sand range from 20 to 90 with an average of 55 and the percent passing a No. 200 sieve ranges between 4 and 28 percent. The natural moisture content of sand ranges between 1.5% and 12.5%, and 18.5% for silt. The dry density ranges between 99 and 120 pcf. These soils are generally dense and of low compressibility. The near-surface soils to depths of 15 to 20 ft have small collapse potential ranging from 0.5% to 1.5%. The bridge foundations are located at depths of 16 to 25 ft below the existing grades depending on the channel condition (lined or unlined) and therefore are not affected by potential collapse of the near-surface soils.

3.3.2 Groundwater

No permanent groundwater was encountered during this investigation, although perched groundwater conditions were encountered in Boring B-2. The area adjacent to the boring was being watered extensively with sprinklers and may have contributed to the perched water condition at this location. Temporary high water table may occur seasonally, especially during floods when water is present in the Amargosa Creek Channel. The finished channel will be EL. 2222.5 feet and the high flood is around EL. 2227.5 feet (Figures 3a and 3b).

4.0 DISCUSSION AND RECOMMENDATIONS

4.1 Seismic Design Considerations

4.1.1 Ground Surface Rupture

The site is not located within the Alquist-Priolo Earthquake Fault Zones. There are no known faults that trend toward or through the project site. However, the site is located with 1,500 to 2,000 feet of the San Andreas Fault (see Figure 6). Therefore, surface rupture is considered low at this time. However, the site is located in a seismically active area in relatively close proximity to one of the major active faults in California. Ground shaking due to nearby and distant earthquakes should be anticipated during the life of the bridge.

4.1.2 Seismic Shaking

The controlling fault for this project is the San Andreas Fault zone with a closest distance of less than 1 km to the southwest of the site. This fault is a strike-slip fault capable of generating earthquakes with a maximum credible earthquake (MCE) magnitude of 8.0. Based on the Caltrans Seismic Hazard Map dated July 1996 (Figure 7), the peak horizontal bedrock acceleration along the project alignment is about 0.7g.

Since the proposed structures are located within 15 km from the controlling fault, we recommend a modified Caltrans Seismic Design Criteria (SDC) ARS curve for Peak Bedrock Acceleration of 0.7g, Soil Profile Type C, and MCE magnitude of 8.0. To account for near-source effect, the following adjustment on the spectral acceleration values was made on the SDC response spectra:

- 20% increase for periods equal to or greater than 1.0 second.
- No changes for periods less than 0.5 second.
- Linear interpolation for periods between 0.5 second and 1.0 second.

Figure 8 shows the recommended ARS curve and tabulated ARS data. The ARS curve should be provided in the Contract Plans for the bridge.

4.1.3 Secondary Seismic Effects

Secondary seismic effects for any site include liquefaction, seismic compaction and settlement, and slope instability.

Liquefaction involves a sudden loss in strength of a saturated, cohesionless soil (predominantly sand) caused by cyclic loading such as an earthquake. This results in temporary transformation of the soil to a fluid mass. Typically, liquefaction occurs in areas where the soils are composed predominantly of saturated poorly consolidated fine sands. The site is located within a liquefaction hazard based on the State Liquefaction Hazard map (Figure 9).

The historic high groundwater depths within the river channel are shown as 0 to 30 feet (California Geologic Survey, 2003). No permanent groundwater was encountered at the bridge site. Water in the channel is present a few times a year during periods of heavy rainfall. USGS data from a station about ½ mile upstream indicates that for the period of 1989 to 1995 for which data was available, water flow in the stream was present from 0 days in 1994 to 16 days in 1992. However, the potential of a major earthquake and a flood when the groundwater is high occurring at the same time is very small. Based on this assumption, it is our opinion that groundwater for liquefaction purposes be assumed to be deeper than 30 feet and therefore, the liquefaction potential is small.

However, to evaluate the effects of liquefaction in the unlikely event of seismic shaking and water in the creek occurring at the same time, we performed a liquefaction analysis assuming groundwater at the river bed. This calculation shows that settlements of 0 to 4 inches could occur in the upper 30 ft due to liquefaction if the maximum credible earthquake occurs at the same time the channel is flooded. The return period of such an event would be on the order of 1 in 10,000 years. Even if such an event were to occur, the bridge foundations are located at a depth of about 16 to 25 feet below the existing grade and the liquefaction settlement below the foundations will be less than 1 inch. However some settlement of the approach fills could occur.

The cyclic loading of an earthquake can cause settlement of loose dry sands. A procedure for estimating the probable settlement of dry sands was developed by Seed and Silver (1972). Tokimatsu and Seed (1987) again reviewed this procedure. Based on this procedure, the seismic compaction settlement of dry sands at the site, if no water is present in the channel, is estimated to be less than 1 inch. Most of the settlement will occur in the upper 15 to 20 feet.

Slope instability, is a potential adverse impact associated with seismic shaking. The bridge abutments are proposed to be vertical concrete structures. Permanent embankment slopes are proposed to be 3:1 (horizontal: vertical) and should be stable in a seismic event. However, unpaved slopes would be subjected to surficial erosion and minor sloughing during heavy rainfall.

4.2 Scour Potential

Based on the hydrology study performed at the site (West Consultants, Inc., 2006), the maximum scour depth is recommended as 11 feet (EL. 2711 feet).

4.3 Shallow Foundations

Based on our field exploration, the subsurface conditions at the bridge site consist primarily of locally medium dense to generally dense to very dense sands and silty sands with some gravel. Some zones of loose to medium dense soils may be encountered in the upper 10 to 15 feet. From a foundation standpoint, the soils below a depth of about 15 ft will generally provide very good bearing support. In addition, all bridge or retaining wall foundations in the creek channel should be founded below the depth of maximum anticipated scour for the unlined channel. Based on the hydrology study performed at the site (West Consultants, Inc., 2006), the maximum scour depth is recommended as 11 feet. Assuming a 2 ft cover, the top of the abutment and retaining wall foundations should be located at a minimum depth of 13 ft below the channel invert or about El. 2710 feet. Assuming a 3-ft thick foundation, the bottom of the abutment and retaining wall foundations will at about El. 2707 ft or about 25 ft below the current site grade of El. 2732 ft for the unlined channel, Alternate 2.

As shown in Figure 4, the soils below the proposed foundation elevation of El. 2707 ft are very dense granular soils. Therefore, spread footings can be used for the foundation support for the abutments and the retaining walls, if Alternative 2 with retaining walls is selected. The foundations at El. 2707 ft will be supported on very dense native soils. We recommend that the footings be supported at a minimum depth of 5 ft below the maximum scour depth for the unlined channel (Alternate 2) and at a depth of 5 ft below the channel invert for the lined channel (Alternate 1).

4.4 Bearing Capacity of Footings

The bearing capacity of spread footings depends on a number of factors, including footing shape, size, depth of embedment, load inclination (horizontal and vertical components), footing base inclination, soil strength, proximity to slopes, tolerable settlement, ground inclination, and eccentric loading conditions due to applied moments or non-centric loads. For level ground conditions with a minimum embedment of 5 ft below the scour depth or channel invert for the unlined and lined channels, respectively, we recommend an allowable bearing pressure of 6 ksf. Ultimate bearing capacity may be taken as 3 times the above allowable value. The geotechnical engineer should observe the excavation before pouring of the footings.

Any soils disturbed by construction operations or softened by wetting should be overexcavted and recompacted to at least 95% relative compaction in accordance with ASTM D 1557.

4.5 Settlement

For the above bearing pressures, total footing settlements are estimated to be an inch or less, and differential settlements between similarly loaded footings are estimated to be ½ inch or less.

4.6 Lateral Resistance of Footings

In general, footing resistance to lateral loads is provided by a combination of frictional sliding resistance at the footing-soil interface and passive soil resistance on the side of the embedded portion of the footing.

An ultimate sliding friction coefficient of 0.35 may be used for the design of footings without a key, and a value of 0.5 may be used for the footings with a key. An equivalent fluid unit weight of 250 pcf may be used for ultimate lateral passive soil resistance for footings poured neatly against competent, undisturbed native material or footings backfilled with 95% compacted structural fill. In unpaved areas, the upper 1-ft should be neglected in the passive pressure computations. Both sliding and passive resistance may be used in combination so that 50% of the passive resistance is added to the friction. The above passive and sliding resistances are considered ultimate values. Minimum factor of safety for sliding under sustained loads should be 1.5, and under seismic loads should be 1.1.

4.7 Ultimate Lateral Capacity of Abutment Walls

The ultimate lateral capacity of an abutment wall is a function of the height of the abutment wall that is acted on by the passive soil pressure on the backfill. The Caltrans Seismic Design Criteria, Section 7.8, dated December 2004 recommends a passive pressure of 5 ksf for a wall height of 5.5 feet based on full-scale abutment testing conducted at UC Davis. Based on Caltrans recent practice, the value of wall height (H) greater than 5.5 ft can be increased by the ratio of H/5.5 but should be limited to a maximum value of 7.3 ksf.

4.8 Retaining Walls

Caltrans Standard retaining walls are proposed on both sides of the channel between the abutment and the bicycle path. Based on Figure 3b, the top of the wall is about El. 2724 ft and bottom of the wall footing is about El. 2407 ft yielding a

17 ft high retaining wall. The foundation conditions are adequate for support of Std. Type 1 retaining walls on spread footings.

4.8.1 Lateral Earth Pressures

For walls backfilled with structure backfill in accordance with Caltrans Standard Specifications, the following lateral earth pressures may be used for design:

Slope Above the Wall	Active Equivalent Fluid Pressure (pcf)	At-Rest Equivalent Fluid Pressure (pcf)
Level	36	55
2H:1V	45	70

Active pressures may be used for walls able to displace at the top 0.2 percent of the wall height, or ¼ inch for each 10-ft of wall height. Walls unable to displace this amount must be designed for at-rest pressures. Surcharge loading on walls with level backfill may be taken as a uniform lateral pressure equal to 30 percent of the vertical surcharge. For normal bikeway traffic, the vertical surcharge can be taken as equivalent to 1-foot of additional backfill, or 120 psf. Walls supporting normal truck traffic may use a vertical surcharge of 240 psf.

4.8.2 Bearing Capacity and Lateral Resistance

The bearing capacity and lateral resistance design parameters for retaining wall footings will be the same as for bridge footings (Sections 4.3 and 4.5). Preparation of spread footing subgrade for the retaining walls should be performed in the same manner as bridge abutment and bent footings, according to the special provisions in Section 4.9. We recommend that retaining wall footings have a minimum embedment of 5 ft below the scour grade.

4.9 Site Earthwork

In general, earthwork should be performed in accordance with Sections 6 and 19 of the Caltrans Standard Specifications. The new construction will have to be carefully planned to protect the many existing utilities in the area.

4.10 Structural Backfill

All backfill placed behind abutment walls and retaining walls should be granular structural backfill compacted to a minimum of 95% relative compaction in accordance with Caltrans Standard Specifications. Operation of heavy compaction

equipment adjacent to abutment walls can cause excessive lateral soil pressures to develop on the wall. For this reason, it is recommended that all fill placed within 5 ft of the wall should be compacted to 90% relative compaction with hand-operated equipment.

4.11 Excavation and Shoring

Excavations to depths of about 25 ft below the existing grade will be required to construct the abutment and retaining wall footings. Groundwater was not encountered to these depths at the time of the field investigation. However, as discussed in Section 4.1.3, based on historical data, water may be present in the channel and may be encountered in excavations during the rainy season up to 16 days in a year. Therefore, dewatering may be required for the excavations depending on the time of the year the construction is performed.

In general, temporary construction excavations may be made at ¾:1 without shoring to a depth of 5 ft below the adjacent surrounding grade. For deeper cuts up to 25 feet, the slopes should be properly shored or sloped back at least 1.5:1 (horizontal:vertical) or flatter. No surcharge loads should be permitted within a horizontal distance equal to the height of cut or 5 ft whichever is greater from the top of the slopes unless the cut is shored. Excavations that extend below an imaginary plane inclined at 45 degrees below the edge of any adjacent existing site foundations should be properly shored to maintain support of the adjacent structures. All excavation and shoring systems should meet the minimum requirements of the Occupational Safety and Health (OSHA) Standards.

For design of temporary shoring, we recommend a uniform rectangular lateral pressure of 25 H psf above water table, where H is the depth of the cut. Below water table, the uniform lateral pressure due to soil should be 13 H psf plus full hydrostatic pressure. In addition, 35% of any surcharge load should be included as a uniform rectangular loading on the wall.

In general, the excavations should be readily accomplished by conventional soil excavation equipment such as loaders, dozers, or track hoes.

4.12 Recommended Pavement Sections

R-value tests were performed on near-surface bulk samples along the proposed alignment. R-values ranging from 55 to 64 were obtained from the tests (see Table B-1 in Appendix B). We recommend an R-value of 50 for design of pavement sections in this project.

We evaluated the minimum pavement sections for Portland cement concrete pavements (PCCP) and asphalt concrete pavements (ACP) using a design R-value of 50 and traffic index values ranging from 5 to 10 normally used for local streets. Caltrans Highway Design Manual (2004) was used in developing the design sections for PCCP and ACP, respectively. The recommended minimum pavement sections are summarized in Tables 1 and 2.

4.13 Soil Corrosivity

Representative samples of the subsurface soils encountered at the site were tested to evaluate the corrosion potential of soils. The tests included pH, resistivity, soluble chloride, and sulfate concentration characteristics. Results of the corrosivity tests performed are presented in Table B-1 in Appendix B.

The pH of the soil ranged from 6.8 to 7.5. The water-soluble chloride content ranged from 92 to 141 ppm. The water-soluble sulfate content ranged from less than 5 ppm to 6 ppm. The minimum resistivity ranged from 2,040 to 4,246 Ohm-cm.

Caltrans Corrosion Guidelines (2003) define a corrosive area as an area where the soil contains more than 500 ppm of chlorides, more than 2,000 ppm of sulfates or pH less than 5.5. Based on these Caltrans criteria the on-site soils are not considered corrosive to concrete foundation structures in contact with in-situ soils.

4.14 Post-Report Geotechnical Input

Post-report geotechnical services will be required during design and construction. It is recommended that Group Delta review foundation plans and specifications prior to finalization. During construction, the geotechnical engineer should be present to observe the soil conditions encountered during excavation of foundations, to verify the applicability of recommendations, and to evaluate the need for design changes, if construction methods or subsurface conditions differ from those anticipated.

5.0 LIMITATIONS

The report, exploration logs, and other materials resulting from Group Delta's efforts were prepared exclusively for the use in designing the proposed project. The report is not intended to be suitable for reuse on extensions, or modifications of the project, or for use on any other development, as it may not contain sufficient or appropriate information for such uses. If this report or portions of this report are provided to contractors or included in specifications, it should be understood that they are provided for information only.

Our recommendations and evaluations were performed using generally accepted engineering approaches and principles available at this time, and the degree of care and skill ordinarily exercised under similar circumstances by reputable geotechnical engineers practicing in this area. No other representation, either expressed or implied, is included in our report.

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TABLES

TABLE 1
RECOMMENDED MINIMUM PCCP STRUCTURAL PAVEMENT SECTIONS
20TH STREET AT AMARGOSA CREEK IMPROVEMENTS

TI	PCCP (inches)	Alternative 1	Alternative 2		
		ACB or LCB (inches)	ATPB or CTPB (inches)	AB (inches)	AS (inches)
8 or less	8	4	4	4	--
8.5 – 10	8.5	5	4	5	--
10.5 – 12	9	5	--	--	--

Notes:

Design R-value = 50

*** The R-value of the basement soil is greater than 50, therefore, AS is not required.**

**** Caltrans requires a minimum of 150 mm of LCB for the ramp termini.**

TI = Traffic Index (20 years)
AB = Aggregate Base, Class 2
AS = Aggregate Subbase, Class 2
ACB = Asphalt Concrete Base
ATPB = Asphalt Treated Permeable Base
CTPB = Cement Treated Permeable Base
LCB = Lean Concrete Base

TABLE 2
RECOMMENDED MINIMUM AC STRUCTURAL PAVEMENT SECTIONS
20TH STREET AT AMARGOSA CREEK IMPROVEMENT

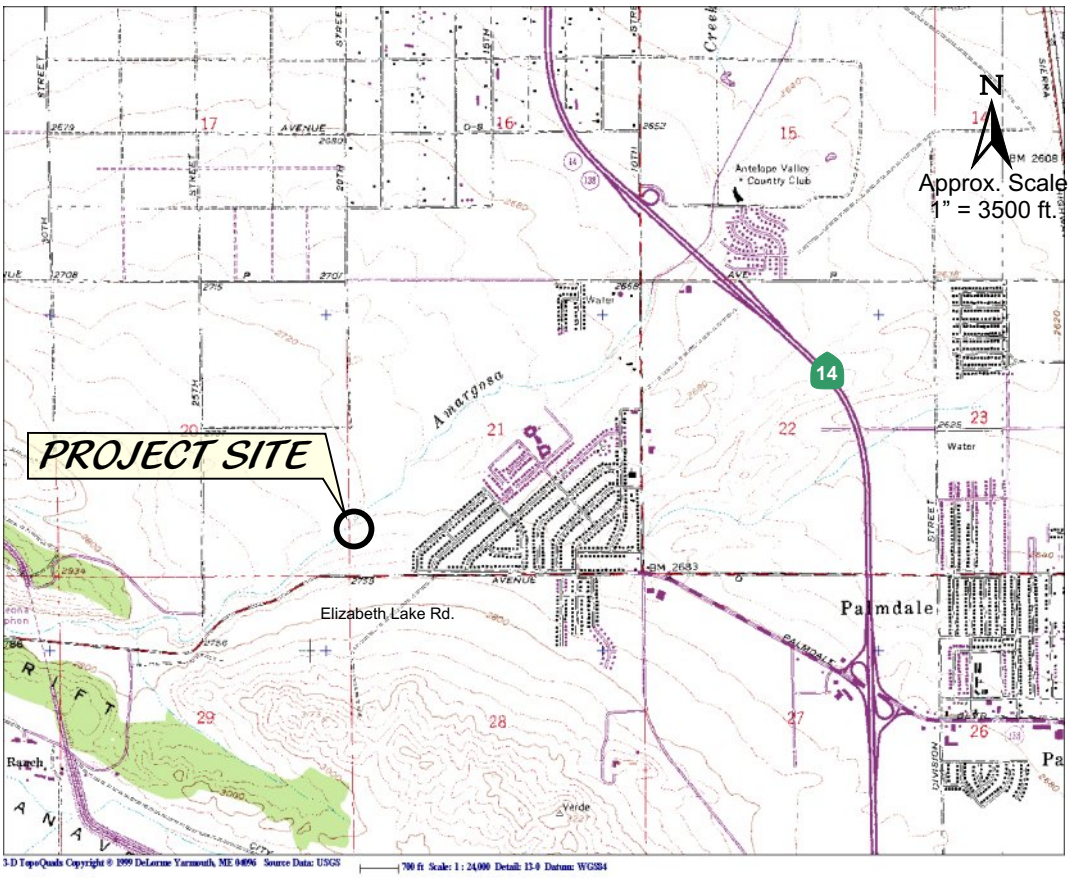
TI	AC (inches)	AB (inches)
5	3	2
6	4	3
7	4	4
8	5	5
9	5	7
10	6	8

Notes:

Design R-value = 50

TI = Traffic Index (20 years)
AB = Aggregate base, Class 2
AC = Asphalt Concrete

FIGURES



The base map is from Delorme's 3D- TopoQuads

GROUP DELTA CONSULTANTS

GDC Project No. I-380

20th Street Overcrossing
over Amargosa Creek
Palmdale, California

Vicinity Map

Figure 1

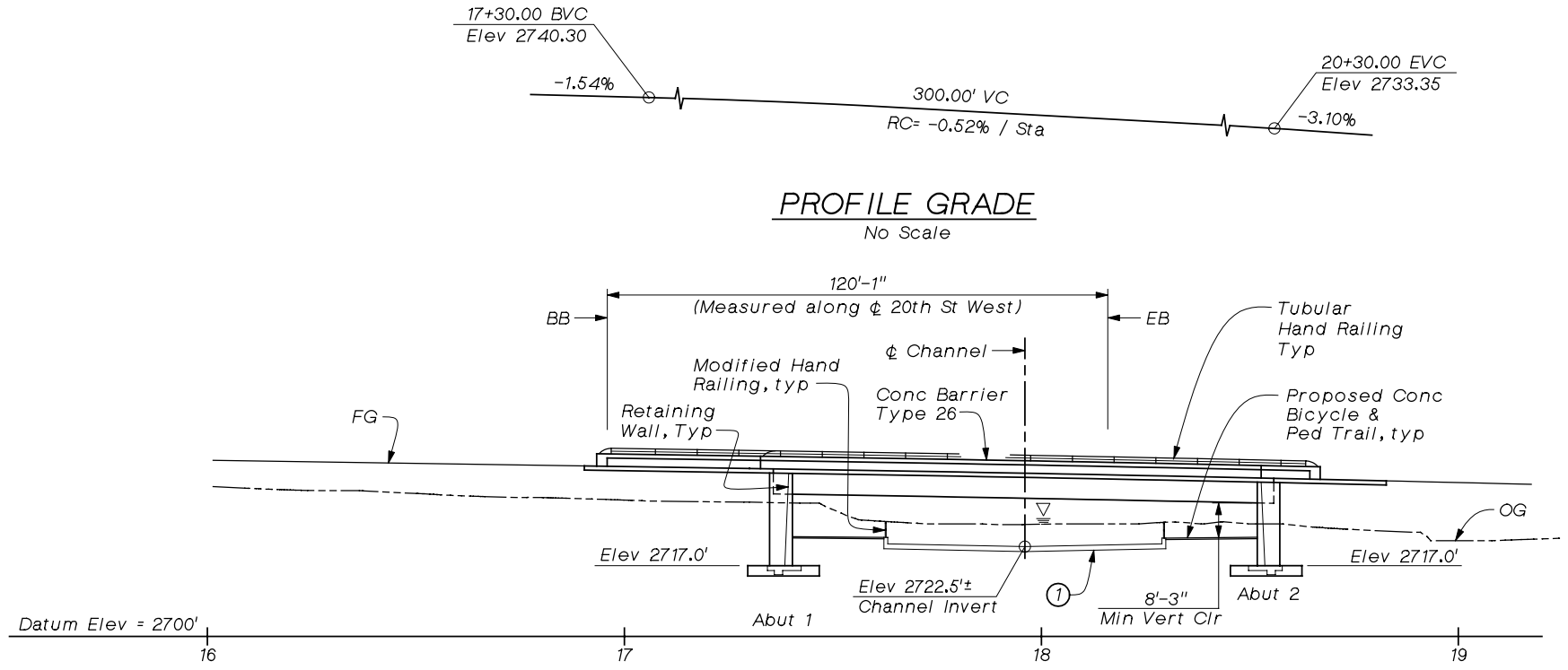
GROUP DELTA CONSULTANTS

GDC Project No. I-380

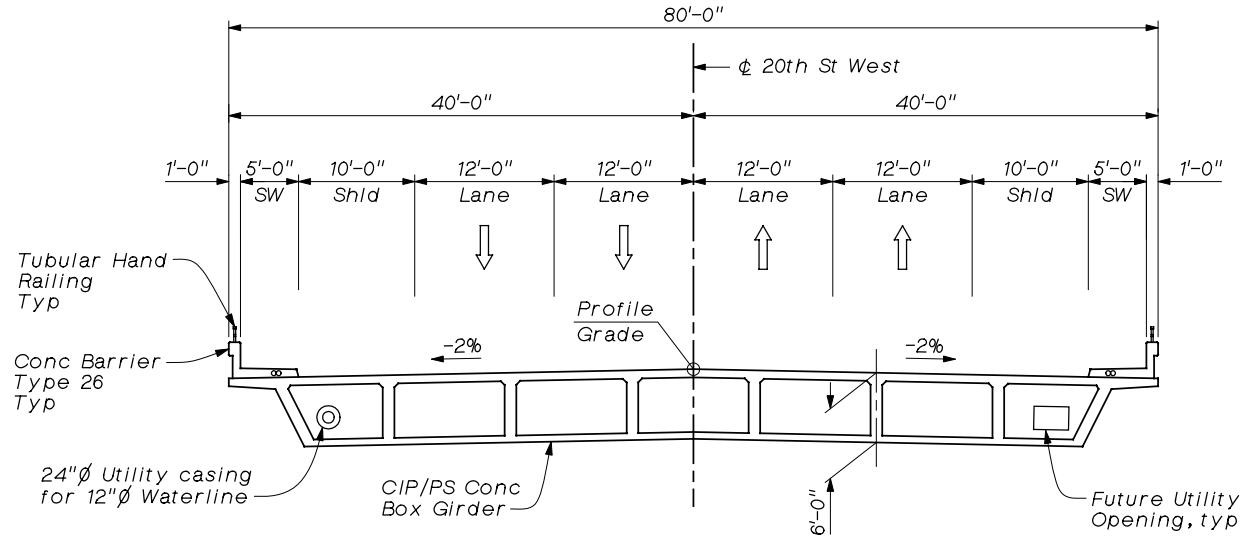
20th Street Overcrossing
over Amargosa Creek
Palmdale, California

Aerial Photograph

Figure 2

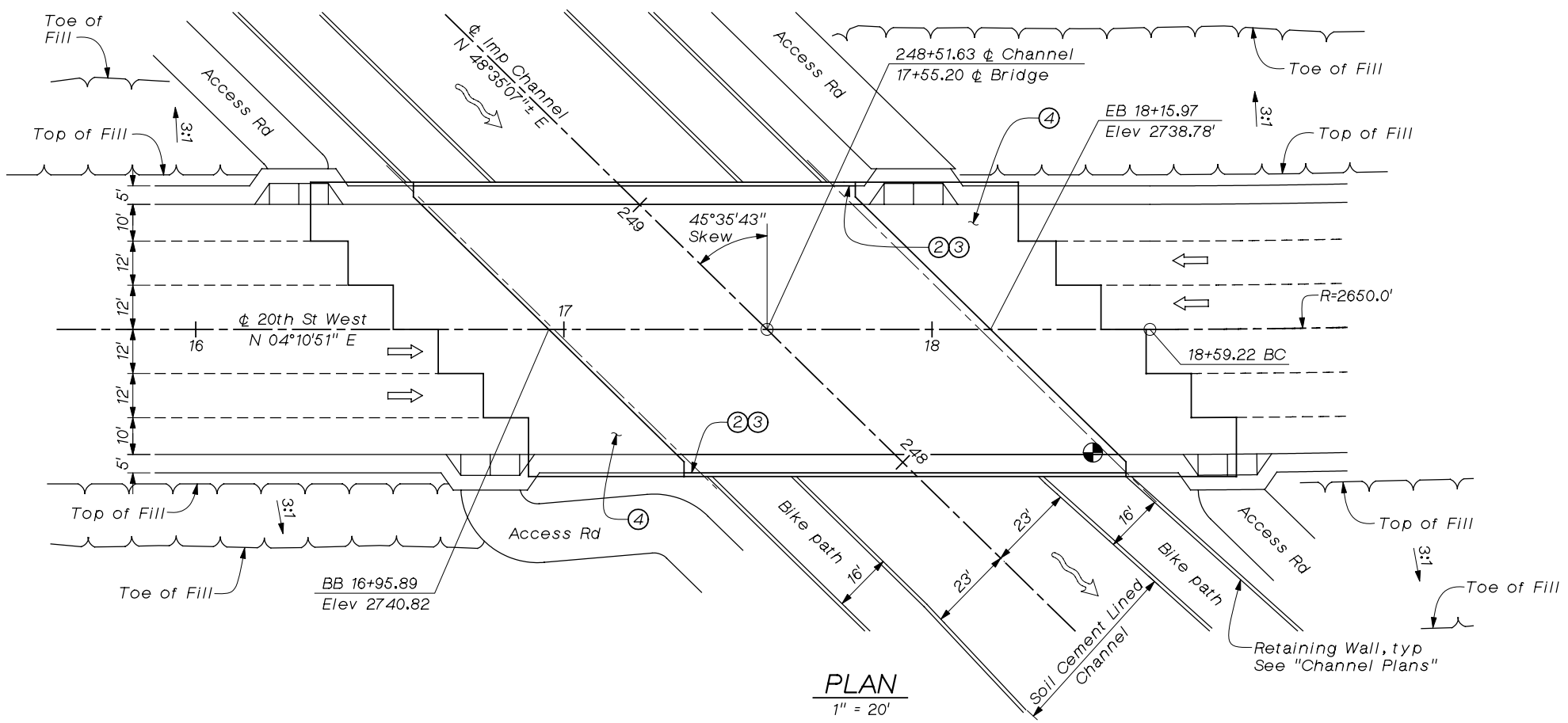


PROFILE GRADE
No Scale



TYPICAL SECTION
1/8" = 1'-0'

ELEVATION
1" = 20'



PLAN
1" = 20'

VEHICULAR TRAFFIC
1. X New alignment. No traffic at the site.
2. ____ Traffic will be detoured away from the site.
3. ____ Traffic will be carried on the structure. Stage construction will/will not be required.
4. ____ Traffic will pass under the structure on _____ (Name of St. or Hwy.)
   - A. ____ No falsework allowed over traffic.
   - B. ____ Falsework opening(s) required:

	Temporary Vertical Clearance	Width of Traffic Opening
___ Bnd.		
___ Bnd.		
___ Two-way		

   - C. ____ Temporary traffic lane reduction needed for footing excavation.

PEDESTRIAN TRAFFIC
Falsework opening(s) required on N/A (Name of St.)

Location	Height	Width

RAILROAD TRAFFIC
Falsework opening(s) required over N/A (Name of RR)

Vertical Clearance	Horizontal Clear Width

LEGEND

1. Soil Cement Lined Channel (Hard Bottom) See "Channel Plans"
2. Paint "Br No"
3. Paint "Bridge Name"
4. Structure Approach Type N(30S)

Approximate High Water Level
Point of Minimum Vertical Clearance
---- Indicates existing roadway
⇨ Direction of Traffic
≈⇨ Direction of Flow

Figure 3a General Bridge Plan , Alternative 1

CITY OF PALMDALE	REVISIONS			
CHECKED BY:	NO.	DESCRIPTION	APPR.	DATE
PLAN CHECK ENGINEER DATE				

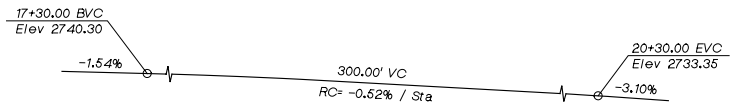
PLANS PREPARED BY:
LAN
LIM & NASCIMENTO ENGINEERING CORP.
12 MAUCHLY, BLDG L
IRVINE, CA 92618
(949) 460-2800

REGISTERED PROFESSIONAL ENGINEER SAM XIE No. C51942 Exp. 6/30/06 CIVIL STATE OF CALIFORNIA

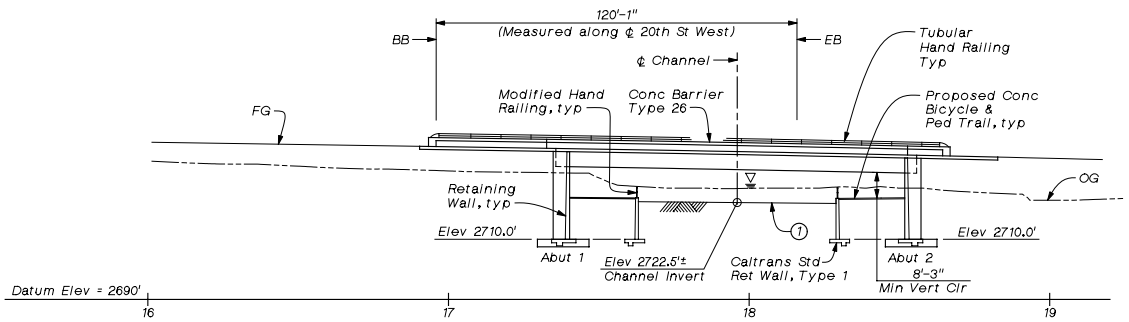
CITY OF PALMDALE
STREET IMPROVEMENT PLANS
20th STREET WEST BRIDGE
GENERAL BRIDGE PLAN

SCALE AS SHOWN
PROJECT NO.
SHT. OF

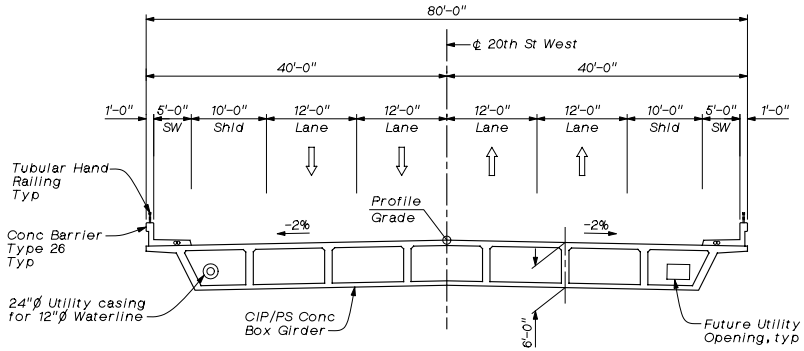
ALTERNATIVE 2



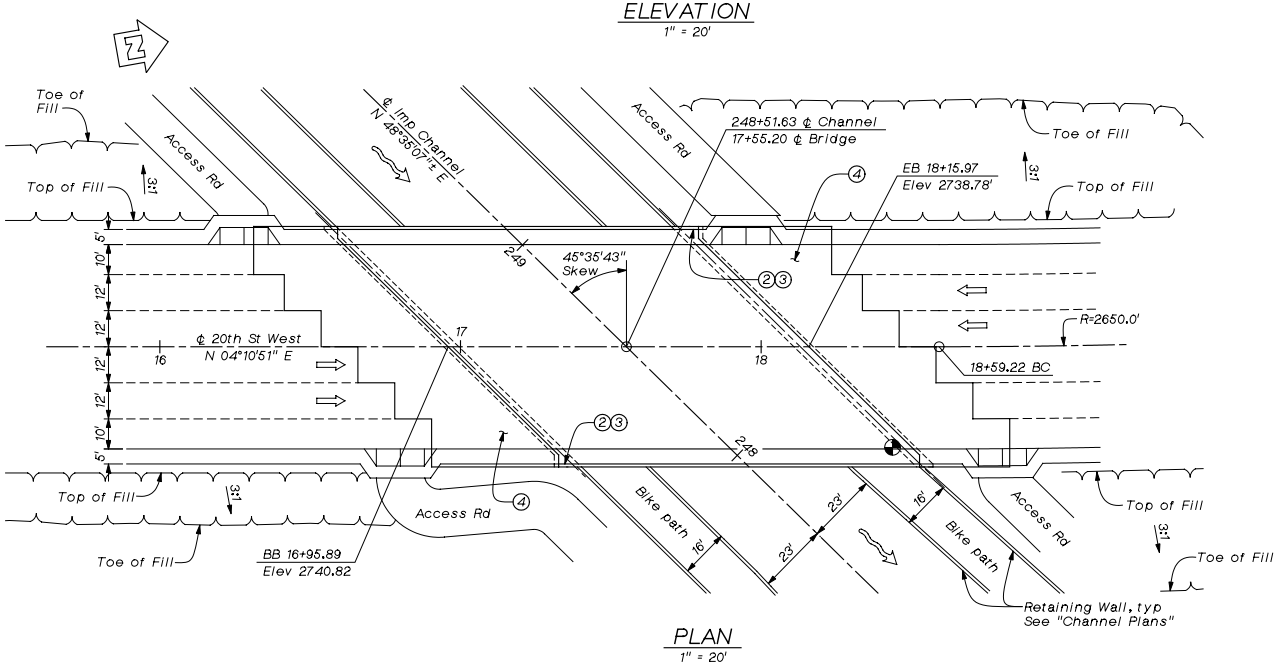
PROFILE GRADE
No Scale



ELEVATION
1" = 20'



TYPICAL SECTION
⅛" = 1'-0'



PLAN
1" = 20'

VEHICULAR TRAFFIC
1. X New alignment. No traffic at the site.
2. ____ Traffic will be detoured away from the site.
3. ____ Traffic will be carried on the structure. Stage construction will/will not be required.
4. ____ Traffic will pass under the structure on _____ (Name of St. or Hwy.)
   A. ____ No falsework allowed over traffic.
   B. ____ Falsework opening(s) required:

	Temporary Vertical Clearance	Width of Traffic Opening
___ Bnd.		
___ Bnd.		
___ Two-way		

   C. ____ Temporary traffic lane reduction needed for footing excavation.

PEDESTRIAN TRAFFIC
Falsework opening(s) required on N/A (Name of St.)

Location	Height	Width

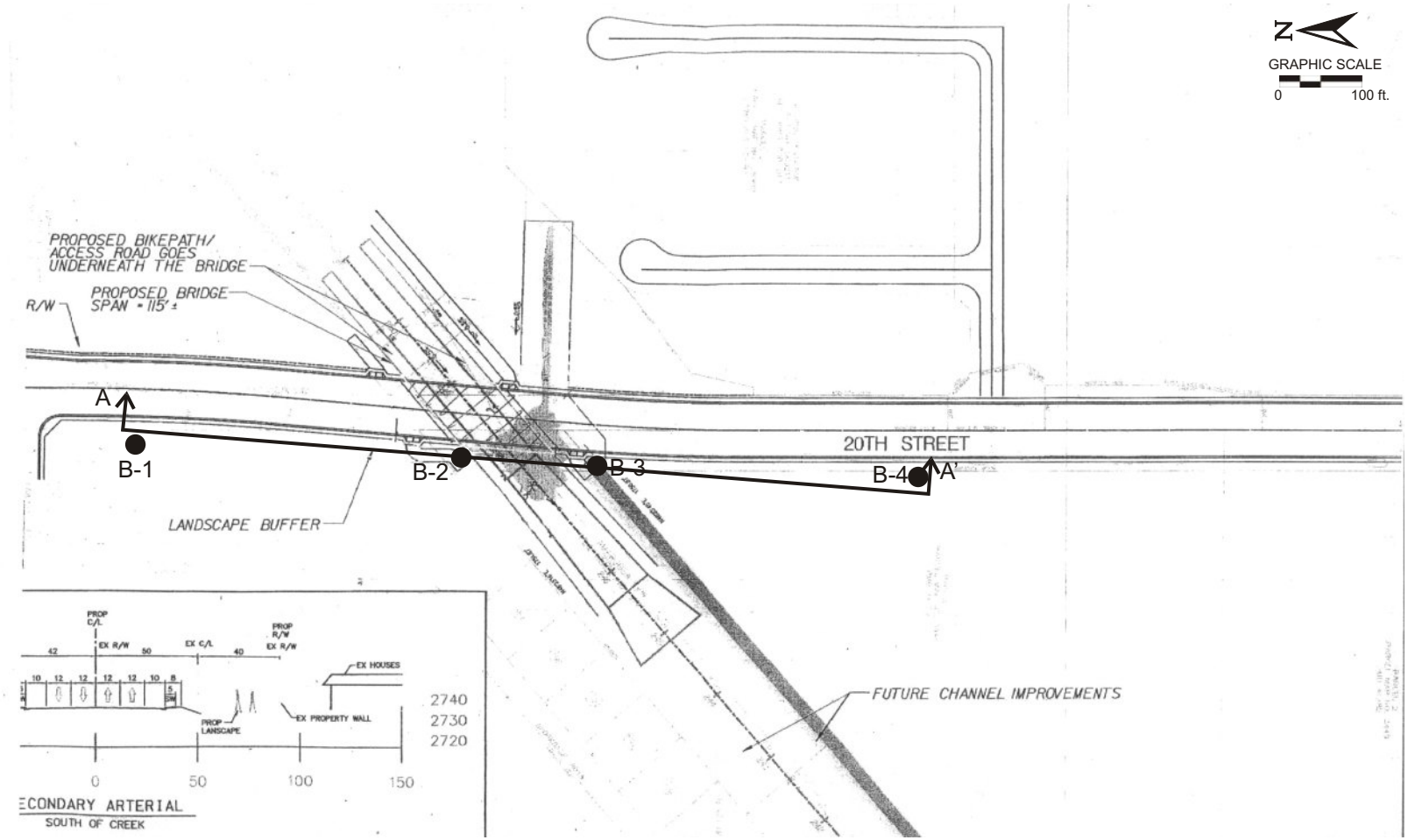
RAILROAD TRAFFIC
Falsework opening(s) required over N/A (Name of RR)

Vertical Clearance	Horizontal Clear Width

LEGEND
- (1) Unlined Channel (Soft Bottom) See "Channel Plans"
- (2) Paint "Br No"
- (3) Paint "Bridge Name"
- (4) Structure Approach Type N(30S)
- Approximate High Water Level
- Point of Minimum Vertical Clearance
- ----- Indicates existing roadway
- Direction of Traffic
- Direction of Flow

Figure 3b General Bridge Plan, Alternate 2

CITY OF PALMDALE	REVISIONS			PLANS PREPARED BY:	CITY OF PALMDALE	SCALE
CHECKED BY:	NO.	DESCRIPTION	APPR. DATE	LIM & NASCIMENTO ENGINEERING CORP.	STREET IMPROVEMENT PLANS	AS SHOWN
PLAN CHECK ENGINEER DATE				12 MAUCHLY, BLDG L IRVINE, CA 92618 (949) 450-2800	20th STREET WEST BRIDGE	PROJECT NO.
				No. C51942 Exp. 6/30/06 CIVIL	GENERAL BRIDGE PLAN	SHT. OF



LEGEND

Approximate location of Boring by GDC

Cross Section (See Figure 4)

Ref. The base map was provided by LAN Engineering

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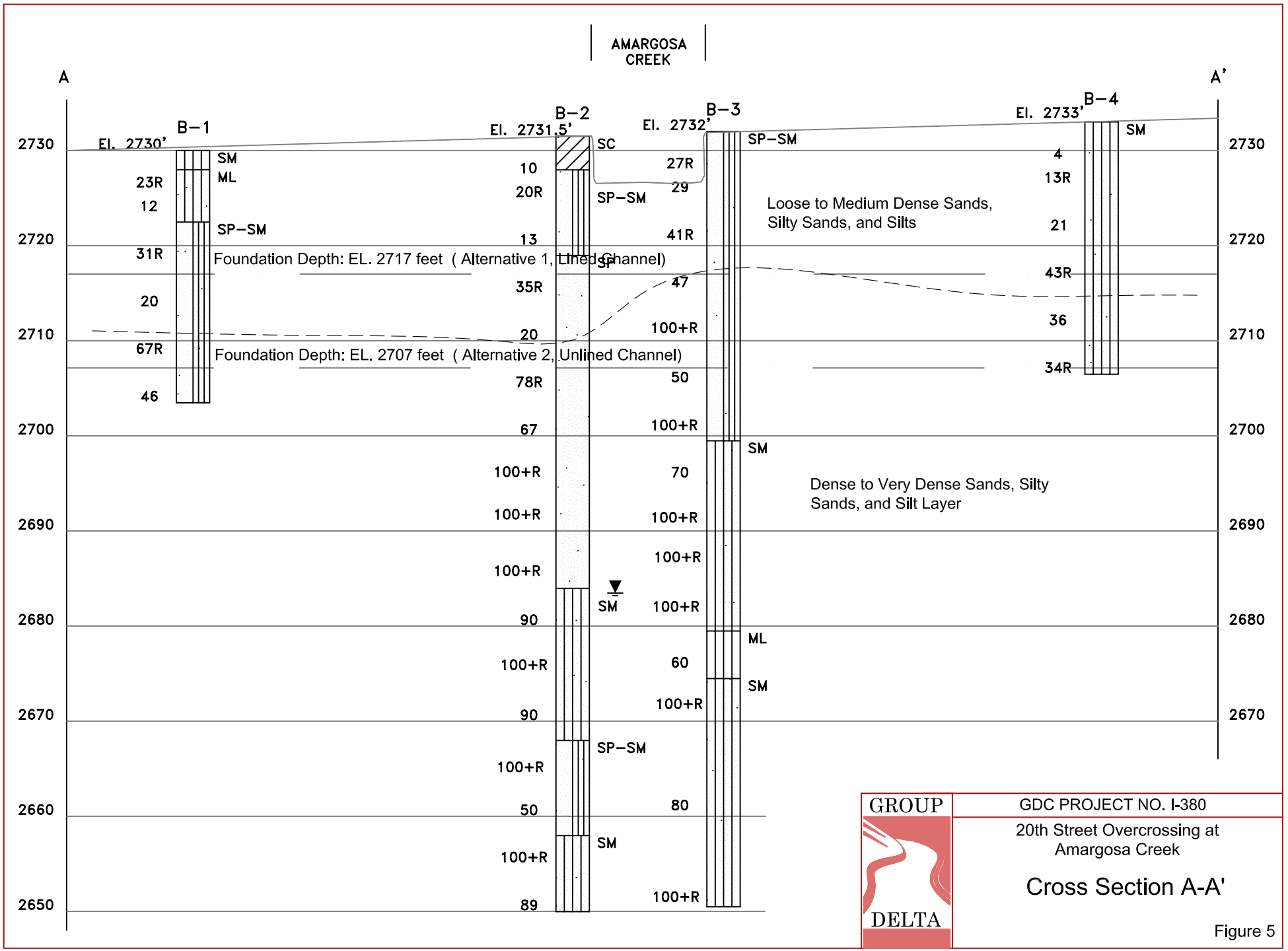
GDC Project No. I-380

20th Street Overcrossing
over Amargosa Creek
Palmdale, California

Boring Location Map

Figure 4



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GDC PROJECT NO. I-380

20th Street Overcrossing at Amargosa Creek

Cross Section A-A'

Figure 5

The base map is from CDMG, Special Studies Zones, Ritter Ridge Quadrangle, January 1979

MAP EXPLANATION

Potentially Active Faults

1906 — Faults considered to have been active during Quaternary time: solid line where accurately located, long dash where approximately located, short dash where inferred, dotted where concealed; query (?) indicates additional uncertainty. Evidence of historic offset indicated by year of earthquake-associated event or C for displacement caused by creep or possible creep.

Aerial photo lineaments (not field checked): based on youthful geomorphic and other features believed to be the results of Quaternary faulting.

Special Studies Zone Boundaries

These are delineated as straight-line segments that connect encircled turning points so as to define special studies zone segments.

Seaward projection of zone boundary.

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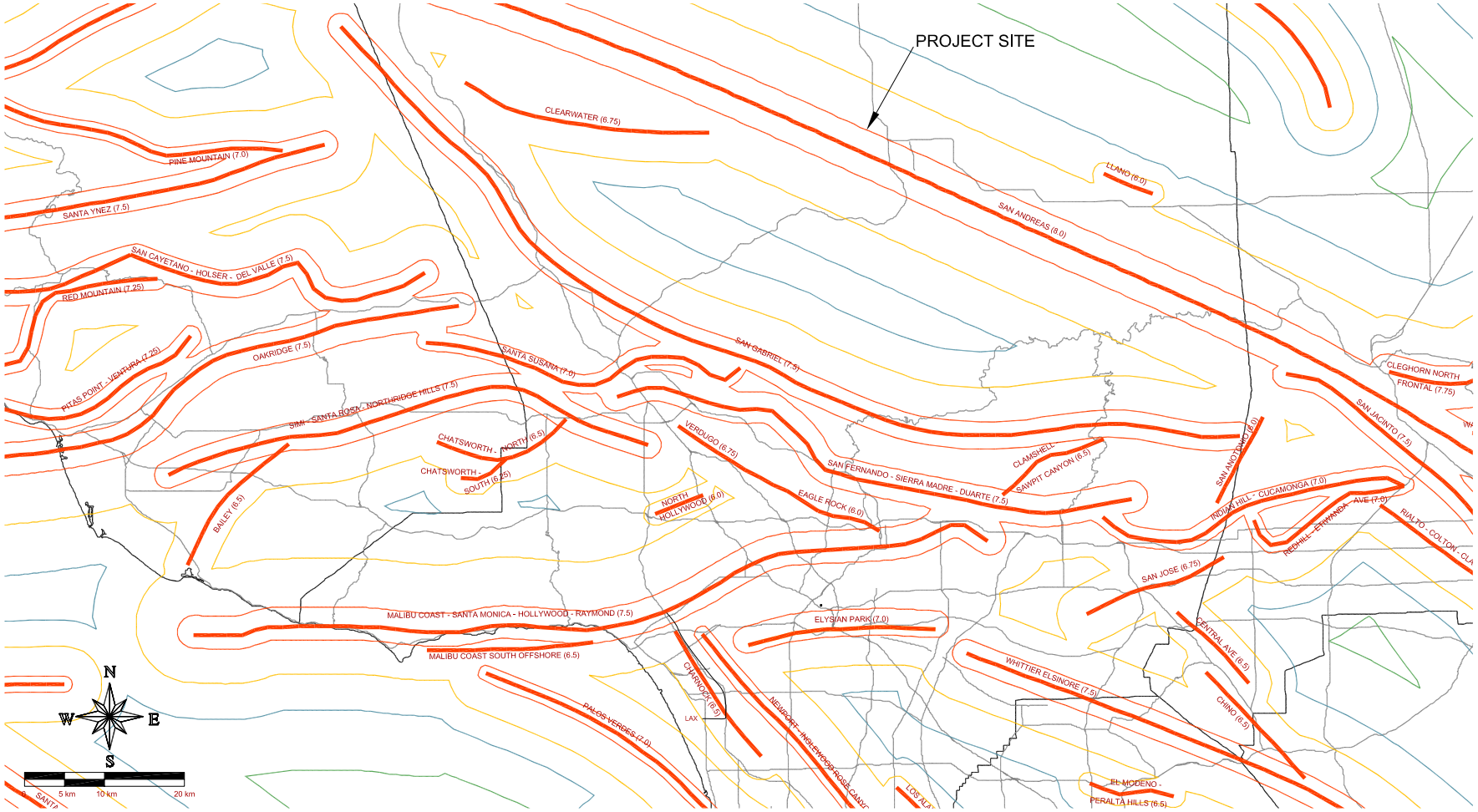
20th Street Overcrossing
over Amargosa Creek
Palmdale, California

Alquist Priolo Special Studies Map

Figure 6



LEGEND

- 0.7g Peak Acceleration Contour
- 0.6g Peak Acceleration Contour
- 0.5g Peak Acceleration Contour
- 0.4g Peak Acceleration Contour
- 0.3g Peak Acceleration Contour
- 0.2g Peak Acceleration Contour
- 0.1g Peak Acceleration Contour

REF. : MUALCHIN, L. 1996, "CALIFORNIA SEISMIC HAZARD MAP 1996"
CALIFORNIA DEPARTMENT OF TRANSPORTATION

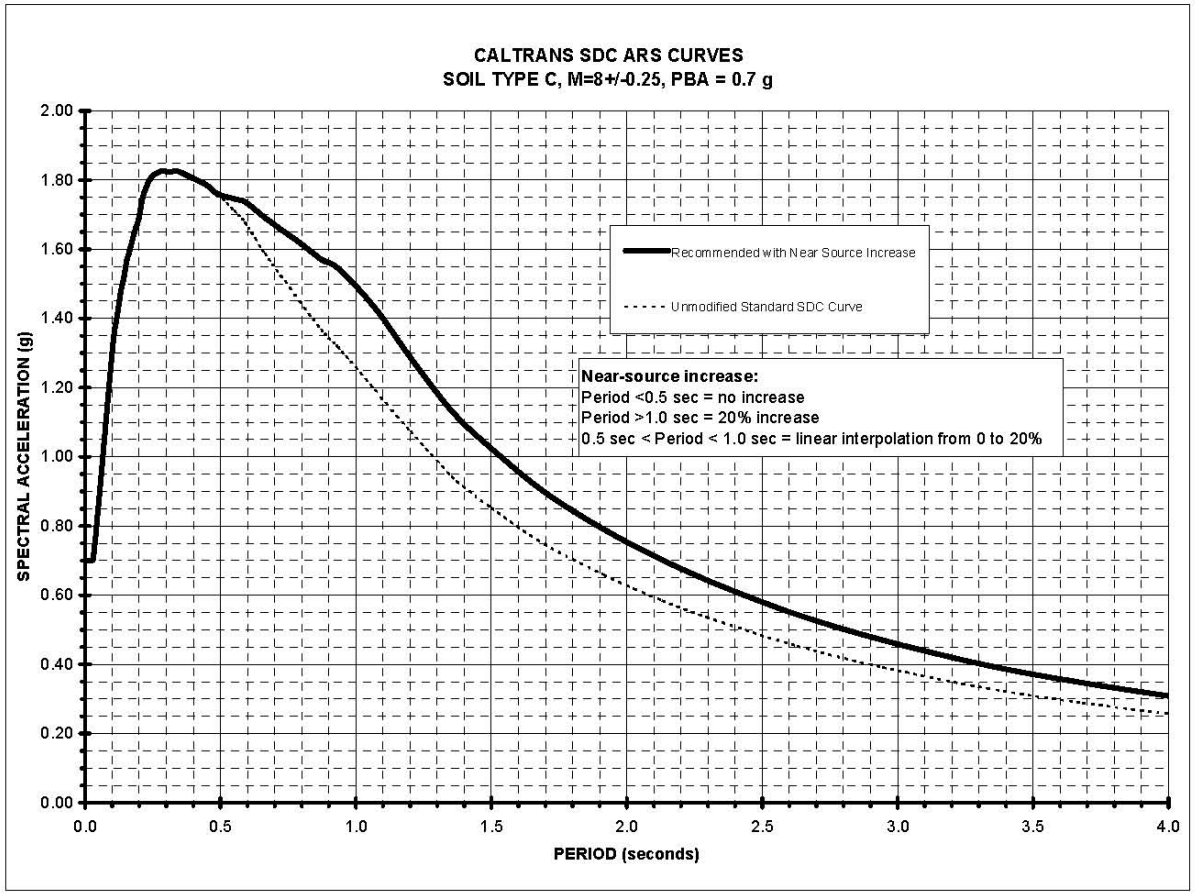
GROUP DELTA

GDC PROJECT NO. I-380

20th Street Overcrossing at Amargosa Creek

Caltrans Fault and PBA Map

Figure 7



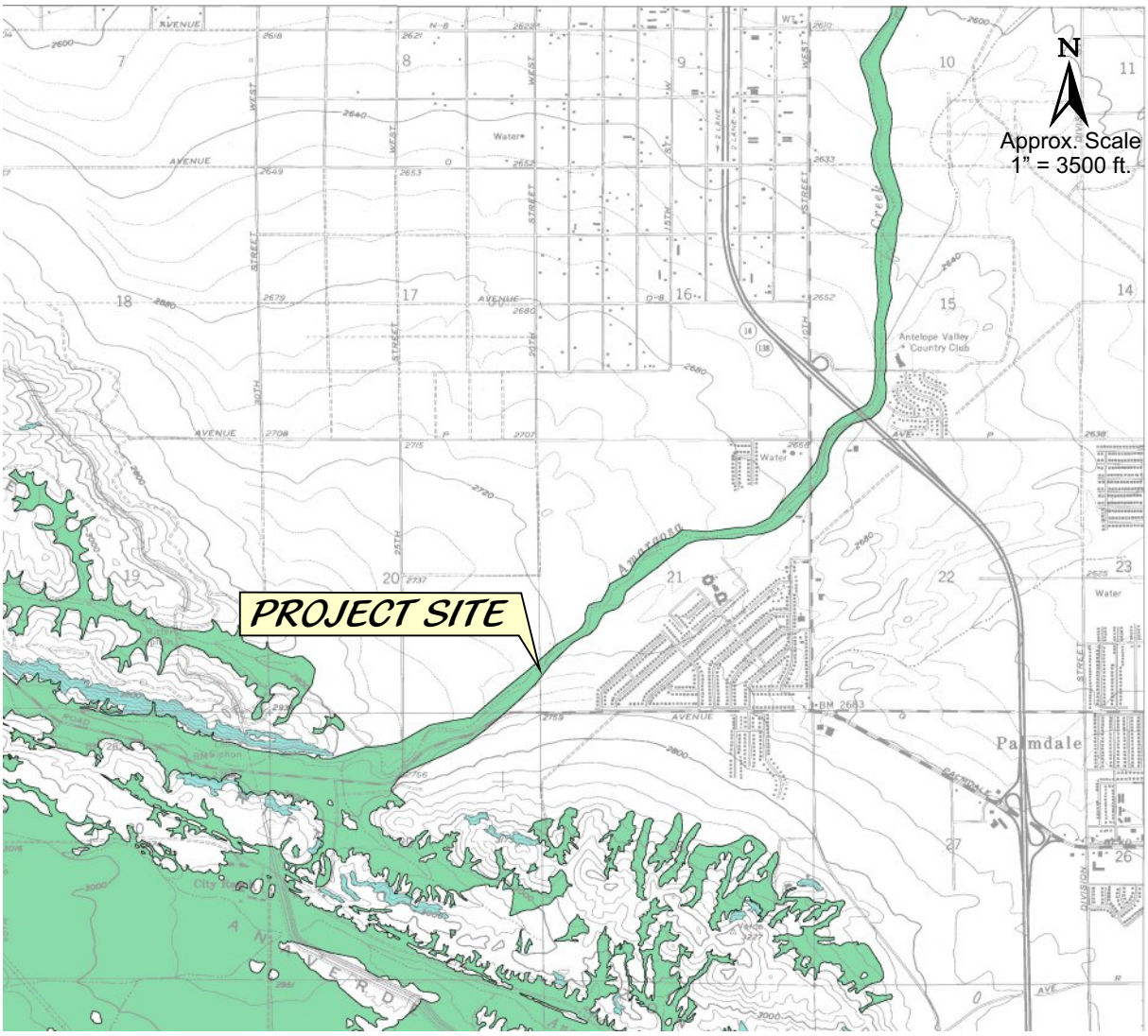
PERIOD (sec)	Unmodified ARS-G'S	Near-Source = Modified ARS-G'S
0.0100	0.7004	0.7004
0.0298	0.7051	0.7051
0.0997	1.3029	1.3029
0.1087	1.3671	1.3671
0.1165	1.3974	1.3974
0.1242	1.4371	1.4371
0.1328	1.4811	1.4811
0.1427	1.5158	1.5158
0.1535	1.5672	1.5672
0.1617	1.5884	1.5884
0.1736	1.6241	1.6241
0.1856	1.6583	1.6583
0.1978	1.6885	1.6885
0.2121	1.7482	1.7482
0.2326	1.7917	1.7917
0.2493	1.8120	1.8120
0.2682	1.8209	1.8209
0.2876	1.8270	1.8270
0.3078	1.8228	1.8228
0.3389	1.8257	1.8257
0.3719	1.8151	1.8151
0.3990	1.8045	1.8045
0.4471	1.7860	1.7860
0.4892	1.7595	1.7595
0.5523	1.7092	1.7450
0.5929	1.6734	1.7356
0.6644	1.5863	1.6906
0.7215	1.5229	1.6578
0.7931	1.4481	1.6179
0.8721	1.3669	1.5703
0.9349	1.3153	1.5441
1.0697	1.1918	1.4302
1.2021	1.0716	1.2859
1.3545	0.9425	1.1310
1.5007	0.8523	1.0228
1.6965	0.7480	0.8976
1.9178	0.6575	0.7890
2.1326	0.5840	0.7008
2.3540	0.5206	0.6247
2.6320	0.4525	0.5430
2.9480	0.3910	0.4692
3.3324	0.3304	0.3965
3.6850	0.2884	0.3461
4.0000	0.2569	0.3083

GDC Project No. I-380

20th Street Bridge over Amargosa Creek
Palmdale, California

ARS Curve

Figure 8



The base map is from California Geologic Survey, Seismic Hazard Zones, Ritter Ridge Quadrangle, Aug. 14, 2003

MAP EXPLANATION

Zones of Required Investigation:

Liquefaction
Areas where historic occurrence of liquefaction, or local geological, geotechnical and groundwater conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

Earthquake-Induced Landslides
Areas where previous occurrence of landslide movement, or local topographic, geological, geotechnical and subsurface water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

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GDC Project No. I-380

20th Street Overcrossing
over Amargosa Creek
Palmdale, California

Liquefaction Hazard Map

Figure 9

APPENDIX A - FIELD INVESTIGATION

APPENDIX A
FIELD INVESTIGATION

A.1 Soil Borings

Four site-specific borings were performed along the proposed extension of the 20th street on November 16 and November 17, 2005. Borings are marked as B-1 through B-4 and were performed using Hollow Stem Auger method. The borings were drilled to maximum depths of 26.5 ft and 81.5 feet below ground surface. Subsurface materials were visually classified and recorded by a GDC field engineer in accordance with the Unified Soil Classification System (USCS).

Relatively undisturbed California samples, standard penetration samples and bulk samples of the encountered materials were obtained from the borings and logged on the boring logs. Relatively undisturbed samples were obtained by a 3.0-inch outside diameter California sampler lined with 2.42-inch inside diameter metal rings. The samples were retained in brass rings and placed in sealed plastic canisters to prevent moisture loss. Standard penetration tests (SPT) were conducted using a standard 2-inch outside diameter and 1.375-inch inside diameter split spoon sampler. SPT samples were placed in re-sealable plastic bags. Both SPT and California samplers were driven with a 140-pound hammer free-falling 30 inches, in accordance with ASTM D-1586. Bulk samples of cuttings were obtained by a shovel and placed into polyethylene bags. All samples were labeled and transported to the laboratory for further inspection and laboratory testing.

The location of the borings is shown in Figure 4 of the report. Pertinent details of the subsurface conditions encountered in the boring are presented on the logs in Figures A-3 through A-6.

A.3 List of Attached Figures

The following figures are attached and complete this appendix:

Figure A-1	Key to Soil Classification
Figure A-2	Boring Log Legend
Figure A-3 through A-6	Boring Logs

KEY FOR SOIL CLASSIFICATION

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D-2487)				
PRIMARY DIVISIONS			GROUP SYMBOL	SECONDARY DIVISIONS
COARSE-GRAINED SOILS (< 50% fines content)	GRAVEL (% GRAVEL > % SAND)	CLEAN GRAVEL (Less than 5% fines)	GW	Well-graded gravel, gravel with sand, little or no fines
			GP	Poorly-graded gravel, gravel with sand, little or no fines
		"DIRTY" GRAVEL (More than 12% fines)	GM	Silty gravel, silty gravel with sand, silty or non-plastic fines
			GC	Clayey gravel, clayey gravel with sand, clayey or plastic fines
	SAND (% SAND ≥ % GRAVEL)	CLEAN SAND (Less than 5% fines)	SW	Well-graded sand, sand with gravel, little or no fines
			SP	Poorly-graded sand, sand with gravel, little or no fines
		"DIRTY" SAND (More than 12% fines)	SM	Silty sand, silty sand with gravel, silty or non-plastic fines
			SC	Clayey sand, clayey sand with gravel, clayey or plastic fines
FINE-GRAINED SOILS (> 50% fines content)	SILTS AND CLAYS (Liquid Limit less than 50)		ML	Inorganic silt, sandy silt, gravelly silt, or clayey silt with low plasticity
			CL	Inorganic clay of low to medium plasticity, sandy clay, gravelly clay, silty clay, Lean Clay
			OL	Low to medium plasticity Silt or Clay with significant organic content (vegetative matter)
	SILTS AND CLAYS (Liquid Limit 50 or more)		MH	Inorganic elastic silt, sandy silt, gravelly silt, or clayey silt of medium to high plasticity
			CH	Inorganic clay of high plasticity, Fat Clay
			OH	Medium to high plasticity Silt or Clay with significant organic content (vegetative matter)
HIGHLY ORGANIC SOILS			PT	Peat or other highly organic soils

Note: Dual symbols are used for coarse grained soils with 5 to 12% fines (ex: SP-SM), and for soils with Atterberg Limits falling in the CL-ML band in the Plasticity Chart
Borderline classifications between groups may be indicated by two symbols separated by a slash (ex: CL/CH, SW/GW).

CONSISTENCY CLASSIFICATION

COARSE GRAINED SOILS		FINE GRAINED SOILS		
Blowcount SPT[1] (CAL)[2]	Consistency	Blowcount[3] SPT[1] (CAL)[2]	Consistency	Undrained Shear Strength[3], S_u (ksf)
		<2 (<3)	Very Soft	< 0.25
0-4 (0-6)	Very Loose	2-4 (3-6)	Soft	0.25 -0.50
5-10 (7-15)	Loose	5-8 (7-12)	Firm	0.50 - 1.0
11-30 (16-45)	Med. Dense	9-15 (13-22)	Stiff	1.0 - 2.0
31-50 (46-75)	Dense	16-30 (23-45)	Very Stiff	2.0 - 4.0
>50 (>75)	Very Dense	>30 (>45)	Hard	>4.0

MOISTURE CLASSIFICATION

DRY - Absence of moisture, dusty, dry to the touch
MOIST- Damp but no visible water
WET- Visible free water, usually soil is below water table

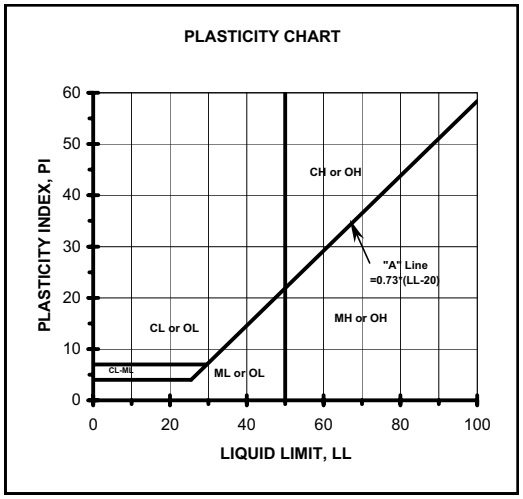
CONSISTENCY NOTES:

1. Number of blows of a 140-lb. hammer falling 30-inches to drive a 2-inch O.D. (1.375-inch I.D.) **SPT Sampler** [ASTM D-1585] the final 12-inches of driving
2. Number of blows of a 140-lb. hammer falling 30-inches to drive a 3-inch O.D. (2.42-inch I.D.) **California Ring Sampler** the final 12-inches of driving.
3. Undrained shear strength of cohesive soils predicted from field blowcounts is generally unreliable. Where possible, consistency should be based on S_u data from pocket penetrometer, torvane, or laboratory testing.

CLASSIFICATION CRITERIA BASED ON LABORATORY TESTS

Grain Size Classification

CLAY AND SILT	SAND			GRAVEL		COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Coarse		
US Std Sieve → **No. 200**	**No. 40**	**No. 10**	**No. 4**	**3/4"**	**3"**	**12"**	
Grain Size (mm) → 0.075	0.425	2	4.75	19.1	76.2	304.8	



Classification of earth materials shown on the logs is based on field inspection and should not be construed to imply laboratory analysis unless so stated.

Granular Soil Gradation Parameters

Coefficient of Uniformity: $C_u = D_{60} / D_{10}$

Coefficient of Curvature: $C_C = (D_{30})^2 / (D_{10} \times D_{60})$

D_{10}= 10% of the soil is finer than this diameter

D_{30}= 30% of the soil is finer than this diameter

D_{60}= 60% of the soil is finer than this diameter

Group Symbol	Gradation or Plasticity Requirement
SW	C_u>6 and C_c between 1 and 3
GW	C_u>4 and C_c between 1 and 3
GP or SP	Clean gravel or sand not meeting requirement for GW or SW
GM or SM	Plots below "A" Line on Plasticity Chart or PI < 4
GC or SC	Plots above "A" Line on Plasticity Chart and PI > 7

Metric Unit Conversion: 1" = 25.4 mm, 1.0 ksf = 47.88 kPa

LOG OF TEST BORING

PROJECT NAME 20th Street West Bridge at Amargosa Creek		**PROJECT NUMBER** I-380	**BORING** **LEGEND**
SITE LOCATION City of Palmdale,CA	**START**	**FINISH**	**SHEET NO.** 1 of 1
DRILLING COMPANY	**DRILLING METHOD**	**LOGGED BY**	**CHECKED BY**
DRILLING EQUIPMENT	**BORING DIA. (in)**	**TOTAL DEPTH (ft)** 30	**GROUND ELEV (ft)**
SAMPLING METHOD		**DEPTH/*ELEV.* GROUND WATER (ft)** ▼ / *na*	**NOTES**

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	DRY DENSITY (pcf)	MOISTURE (%)	OTHER TESTS	% PASSING #200	ATTERBERG LIMITS LL:PI	POCKET PEN (tsf)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
5			1									GRAB, CAL, SPT - Refers to the sampling method as described below GRAB - Refers to collecting sample by method of placing disturbed soil cuttings into a plastic bag
10			2									CAL (CALIFORNIA MODIFIED) - A 3.0" o.d. split tube sampler lined with 2.42" i.d. metal sample rings generally driven into the soil by a free falling hammer
15			3									SPT (STANDARD PENETRATION TEST) - A 2.0" o.d. split spoon sampler with a 1.375" i.d. generally driven into the soil with a 140# hammer free falling a height of 30"
20												ABBREVIATIONS FOR OTHER TESTS: AL = Atterberg Limits GS = Grain Size Analyses CN = Consolidation PP = Pocket Pen CO = Corrosivity CP = Laboratory Compaction RV = R-Value WA = Wash on #200 Sieve DS = Direct Shear EI = Expansion Index TV=Torvane COLL=Collapse Potential of Soil
25												

GDC_LOG_BORING_1A AMARGOSA CREEK BRIDGE.GPJ GDCLOG.GDT 3/23/06

GROUP DELTA CONSULTANTS, INC.
92 Argonaut, Suite 120
Aliso Viejo, CA 92656

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

FIGURE A-2

LOG OF TEST BORING

PROJECT NAME	20th Street West Bridge at Amargosa Creek	**PROJECT NUMBER**	I-380
BORING	**B-1**		
SITE LOCATION	City of Palmdale,CA	**START**	11/16/2005
FINISH	11/16/2005	**SHEET NO.**	1 of 1
DRILLING COMPANY	Jet Drilling	**DRILLING METHOD**	Hollow Stem Auger
LOGGED BY	V.Glisic	**CHECKED BY**	K.Bhushan
DRILLING EQUIPMENT	CME 75	**BORING DIA. (in)**	6
TOTAL DEPTH (ft)	26.5	**GROUND ELEV (ft)**	2730
DEPTH/*ELEV.* GROUND WATER (ft)	▼ Not Encountered / *na*		
SAMPLING METHOD	Downhole Hammer: 140 lbs., Drop: 30 in.	**NOTES**	

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	DRY DENSITY (pcf)	MOISTURE (%)	OTHER TESTS	% PASSING #200	ATTERBERG LIMITS LL:PI	POCKET PEN (tsf)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
			1			3.9	RV					**Silty Sand (SM)** Damp to moist, brown
			2	6 9 14	105	7.5						**Sandy Silt (ML)** Medium dense, moist to damp, reddish brown with fine sand
5	2725		3	5 5 7		17.2						
												Poorly graded Sand with Silt (SP-SM) Medium dense, dry to damp, reddish brown medium to coarse
10	2720		4	10 13 18	109	2						
15	2715		5	8 8 12		2.6						with occasional gravel
20	2710		6	24 34 33	116	2.1						Becomes dense, dry, grayish brown
25	2705		7	15 23 23		2.3						
												Boring completed @ 26.5 feet. Groundwater not encountered. Borehole backfilled with soil cuttings.

GDC_LOG_BORING_1A AMARGOSA CREEK BRIDGE.GPJ GDCLOG.GDT 3/23/06

GROUP DELTA CONSULTANTS, INC.
92 Argonaut, Suite 120
Aliso Viejo, CA 92656

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

FIGURE A-3

LOG OF TEST BORING

PROJECT NAME 20th Street West Bridge at Amargosa Creek		**PROJECT NUMBER** I-380	**BORING** **B-2**
SITE LOCATION City of Palmdale,CA	**START** 11/17/2005	**FINISH** 11/17/2005	**SHEET NO.** 1 of 3
DRILLING COMPANY Jet Drilling	**DRILLING METHOD** Hollow Stem Auger	**LOGGED BY** V.Glisic	**CHECKED BY** K.Bhushan
DRILLING EQUIPMENT CME 75	**BORING DIA. (in)** 6	**TOTAL DEPTH (ft)** 81.5	**GROUND ELEV (ft)** 2731.5
SAMPLING METHOD Downhole Hammer: 140 lbs., Drop: 30 in.			**DEPTH/*ELEV.* GROUND WATER (ft)** ▼ 48.0 / *2683.5*

NOTES

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	DRY DENSITY (pcf)	MOISTURE (%)	OTHER TESTS	% PASSING #200	ATTERBERG LIMITS LL:PI	POCKET PEN (tsf)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
	2730		1			5.4	CO					**Clayey Sand (SC)** loose to medium dense, moist to damp, reddish brown, with fine-grained sand
			2	3 5 5		6.7						
5	2725		3	7 10 10	106	3.5	COLL					**Poorly graded Sand with Silt (SP-SM)** Medium dense, moist to damp, reddish brown fine grained
10	2720		4	7 6 7		1.5		11				Becomes olive brown, fine to medium, less fines
15	2715		5	12 17 18	102	1.5	COLL	3				**Poorly Graded Sand (SP)** Medium dense, damp, grayish brown, medium to fine grained Trace of gravel Becomes with fine gravel
20	2710		6	11 10 10		2		4				
25	2705		7	18 33 45	119	2.4	COLL					Becomes very dense, reddish to grayish brown, medium to coarse with gravel up to 1"

GDC_LOG_BORING_1A AMARGOSA CREEK BRIDGE.GPJ GDCLOG.GDT 3/23/06

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THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

FIGURE A-4 a

LOG OF TEST BORING

PROJECT NAME	PROJECT NUMBER	BORING
20th Street West Bridge at Amargosa Creek	I-380	**B-2**

SITE LOCATION	START	FINISH	SHEET NO.
City of Palmdale,CA	11/17/2005	11/17/2005	2 of 3

DRILLING COMPANY	DRILLING METHOD	LOGGED BY	CHECKED BY
Jet Drilling	Hollow Stem Auger	V.Glisic	K.Bhushan

DRILLING EQUIPMENT	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GROUND WATER (ft)
CME 75	6	81.5	2731.5	▼ 48.0 / *2683.5*

SAMPLING METHOD
Downhole Hammer: 140 lbs., Drop: 30 in.

NOTES

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	DRY DENSITY (pcf)	MOISTURE (%)	OTHER TESTS	% PASSING #200	ATTERBERG LIMITS LL:PI	POCKET PEN (tsf)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
	2700		8	16 17 50		3.7		8				**Poorly graded Sand with Silt (SP-SM)** Very dense, damp, reddish to grayish brown, medium grained with some gravel
35	2695		9	30 50/6"	110	6.2						
40	2690		10	25 50/2"		5.3		11				3" rock in cuttings
45	2685		11	30 50/5"	120	12.9						Becomes reddish brown with more fines
												▼ **Silty Sand (SM)** Very dense, wet, reddish brown, fine to medium grained Perched water encountered at 48 feet bgs
50	2680		12	29 40 50		10.7		28				
55	2675		13	39 50/4"	115	11.9						

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FIGURE A-4 b

LOG OF TEST BORING

PROJECT NAME 20th Street West Bridge at Amargosa Creek		**PROJECT NUMBER** I-380	**BORING** B-2
SITE LOCATION City of Palmdale,CA	**START** 11/17/2005	**FINISH** 11/17/2005	**SHEET NO.** 3 of 3
DRILLING COMPANY Jet Drilling	**DRILLING METHOD** Hollow Stem Auger	**LOGGED BY** V.Glisic	**CHECKED BY** K.Bhushan
DRILLING EQUIPMENT CME 75	**BORING DIA. (in)** 6	**TOTAL DEPTH (ft)** 81.5	**GROUND ELEV (ft)** 2731.5
SAMPLING METHOD Downhole Hammer: 140 lbs., Drop: 30 in.			**DEPTH/*ELEV.* GROUND WATER (ft)** ▼ 48.0 / *2683.5*

NOTES

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	DRY DENSITY (pcf)	MOISTURE (%)	OTHER TESTS	% PASSING #200	ATTERBERG LIMITS LL:PI	POCKET PEN (tsf)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
	2670		14	29 40 50		8.3		23				**Silty Sand (SM)** Very dense, wet, reddish brown, fine to medium grained Very hard drilling
65												**Poorly graded Sand with Silt (SP-SM)** Very dense, damp to moist, reddish to grayish brown, with some gravel
	2665		15	31 50/5"	108	7						
70												Continues with no gravel
	2660		16	20 20 30		4.8		10				
75												**Silty Sand (SM)** Very dense, damp to moist, reddish to grayish brown, fine to medium grained with some gravel
	2655		17	30 50/5"	110	12.2						
80												Continues with no gravel and more fines
	2650		18	20 39 50		12.6						
												Boring completed @81.5 feet below ground surface. Water encountered @48 feet-perched water? Borehole backfilled with soil cuttings.
85												
	2645											

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FIGURE A-4 c

LOG OF TEST BORING

PROJECT NAME 20th Street West Bridge at Amargosa Creek		**PROJECT NUMBER** I-380	**BORING** B-3
SITE LOCATION City of Palmdale,CA	**START** 11/16/2005	**FINISH** 11/16/2005	**SHEET NO.** 1 of 3
DRILLING COMPANY Jet Drilling	**DRILLING METHOD** Hollow Stem Auger	**LOGGED BY** V.Glisic	**CHECKED BY** K.Bhushan
DRILLING EQUIPMENT CME 75	**BORING DIA. (in)** 6	**TOTAL DEPTH (ft)** 81.5	**GROUND ELEV (ft)** 2732
DEPTH/*ELEV.* GROUND WATER (ft) ▼ Not Encountered / *na*			
SAMPLING METHOD Downhole Hammer: 140 lbs., Drop: 30 in.		**NOTES**	

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	DRY DENSITY (pcf)	MOISTURE (%)	OTHER TESTS	% PASSING #200	ATTERBERG LIMITS LL:PI	POCKET PEN (tsf)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
	2730		1			2.7	CO					**Poorly graded Sand with Silt (SP-SM)** Loose, dry to damp, brown to olive brown, fine to medium with trace of gravel
			2	12 9 18	118	3.0						
5	2725		3	12 14 15		2.5						
10	2720		4	15 16 25	118	2.5						Continues with less fines and no gravel
15	2715		5	15 18 29		3.2						Becomes dense
20	2710		6	25 35 50/5"	117	3.6						Becomes very dense, slightly cemented, medium grained
25	2705		7	11 25 25		3.8						

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FIGURE A-5 a

LOG OF TEST BORING

PROJECT NAME	PROJECT NUMBER	BORING
20th Street West Bridge at Amargosa Creek	I-380	**B-3**

SITE LOCATION	START	FINISH	SHEET NO.
City of Palmdale,CA	11/16/2005	11/16/2005	2 of 3

DRILLING COMPANY	DRILLING METHOD	LOGGED BY	CHECKED BY
Jet Drilling	Hollow Stem Auger	V.Glisic	K.Bhushan

DRILLING EQUIPMENT	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GROUND WATER (ft)
CME 75	6	81.5	2732	▼ Not Encountered / *na*

SAMPLING METHOD
Downhole Hammer: 140 lbs., Drop: 30 in.

NOTES

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	DRY DENSITY (pcf)	MOISTURE (%)	OTHER TESTS	% PASSING #200	ATTERBERG LIMITS LL:PI	POCKET PEN (tsf)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
	2700		8	20 30 50/5"	118	3.6						**Poorly Graded Sand with Silt(SP-SM)** Very dense, damp, brown, coarse grained Continues with trace of gravel
35	2695		9	26 35 35		6.7						**Silty Sand (SM)** Very dense, damp, reddish brown, medium grained with trace of gravel Hard drilling
40	2690		10	35 50/6"	103	5.6						Continues with trace of gravel
45	2685		11	30 50/6"		5.3						Continues without gravel
50	2680		12	50/5"	119	5.8						Low sample recovery.
55	2675		13	46 30 30		18.5						**Sandy Silt (ML)** Very dense, moist, reddish brown with fine sand 2" layer of clean sand **Silty Sand (SM)** Very dense, moist, reddish brown, medium grained

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FIGURE A-5 b

LOG OF TEST BORING

PROJECT NAME	PROJECT NUMBER	BORING
20th Street West Bridge at Amargosa Creek	I-380	**B-3**

SITE LOCATION	START	FINISH	SHEET NO.
City of Palmdale,CA	11/16/2005	11/16/2005	3 of 3

DRILLING COMPANY	DRILLING METHOD	LOGGED BY	CHECKED BY
Jet Drilling	Hollow Stem Auger	V.Glisic	K.Bhushan

DRILLING EQUIPMENT	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GROUND WATER (ft)
CME 75	6	81.5	2732	▼ Not Encountered / *na*

SAMPLING METHOD
Downhole Hammer: 140 lbs., Drop: 30 in.

NOTES

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	DRY DENSITY (pcf)	MOISTURE (%)	OTHER TESTS	% PASSING #200	ATTERBERG LIMITS LL:PI	POCKET PEN (tsf)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
			14	50/5"								**Silty Sand (SM)** Very dense, moist, reddish brown, medium grained Hard drilling continues
	2670		14	50/6"		11.1						
65												
	2665											
70			15	21 40 40		9.3						
	2660											
75												
	2655											
80			16	50/5"	99	6.7						
	2650											Boring completed @ 81.5 feet below ground surface. Groundwater not encountered. Borehole backfilled with soil cuttings.
85												
	2645											

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FIGURE A-5 c

LOG OF TEST BORING

PROJECT NAME	20th Street West Bridge at Amargosa Creek	**PROJECT NUMBER**	I-380
BORING	**B-4**		
SITE LOCATION	City of Palmdale,CA	**START**	11/16/2005
FINISH	11/16/2005	**SHEET NO.**	1 of 1
DRILLING COMPANY	Jet Drilling	**DRILLING METHOD**	Hollow Stem Auger
LOGGED BY	V.Glisic	**CHECKED BY**	K.Bhushan
DRILLING EQUIPMENT	CME 75	**BORING DIA. (in)**	6
TOTAL DEPTH (ft)	26.5	**GROUND ELEV (ft)**	2733
DEPTH *ELEV.* GROUND WATER (ft)	▼ Not Encountered / *na*		
SAMPLING METHOD	Downhole Hammer: 140 lbs., Drop: 30 in.	**NOTES**	

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	DRY DENSITY (pcf)	MOISTURE (%)	OTHER TESTS	% PASSING #200	ATTERBERG LIMITS LL:PI	POCKET PEN (tsf)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
			1			4.2	RV					**Silty Sand(SM)** Loose, damp, reddish brown, medium grained
	2730		2	1 2 2		6						
5			3	3 3 10	109	6						
	2725											
10			4	12 13 8		4.7						Becomes medium dense, reddish to grayish brown with some gravel or pieces of rock
	2720											
15			5	14 20 23	120	4.1						
	2715											
20			6	14 16 20		3.7						becomes dense
	2710											
25			7	17 12 22	117	8.6						Becomes medium dense, moist, with more fines and no gravel.
	2705											Boring completed @ 26.5 feet below ground surface. Groundwater not encountered. Borehole backfilled with soil cuttings.

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FIGURE A-6

APPENDIX B – LABORATORY TESTING

APPENDIX B
LABORATORY TESTING

B.1 General

The laboratory testing was performed by Group Delta Consultants Laboratories and this investigation includes determination of moisture content and dry unit weight, percent passing no. 200 sieve, R-value, collapse potential and soil corrosivity. Descriptions of these tests are given below.

B.2 Soil Classification

The subsurface materials were classified visually in the field using the Unified Soil Classification System (USCS), in accordance with ASTM Test Methods D-2487 and D 2488. Soil classifications were modified as necessary based on further inspection and testing in the laboratory. The soil classifications are presented on key for soil classification and on the boring logs Figures A-1 to A-6 of Appendix A.

B.3 Moisture Content and Dry Unit Weight

The field moisture and dry unit weight of each relatively undisturbed sample were determined in general accordance with ASTM D-2216. Results of these tests are presented on the boring logs in Figures A-3 through A-6 of Appendix A.

B.4 Percent Passing no. 200 sieve:

Representative samples were dried, weighed, soaked in water until individual soil particles were separated, and then washed on the No. 200 sieve. The portion of the material retained on the No. 200 sieve was oven-dried and then run through a standard set of sieves in accordance with ASTM D-422. The percentage of fines (i.e., soil passing #200 sieve) is presented on the boring logs in Figures A-3 through A-6 of Appendix A.

B.5 R-value Test

An R-value test was performed on two selected samples of the near surface subgrade soil. The tests were conducted in general accordance with CTM 301. The test results are presented in Table B-1.

B.6 Collapse Potential

Three collapse potential tests were performed in general accordance with ASTM D-5333. Collapse potential of soil method is used to determine the magnitude of collapse of soil that may occur for a given vertical (axial) stress when

unsaturated soils become 100% saturated with fluid. The test results are presented in Figures B-1 through B-3.

B.7 Soil Corrosivity

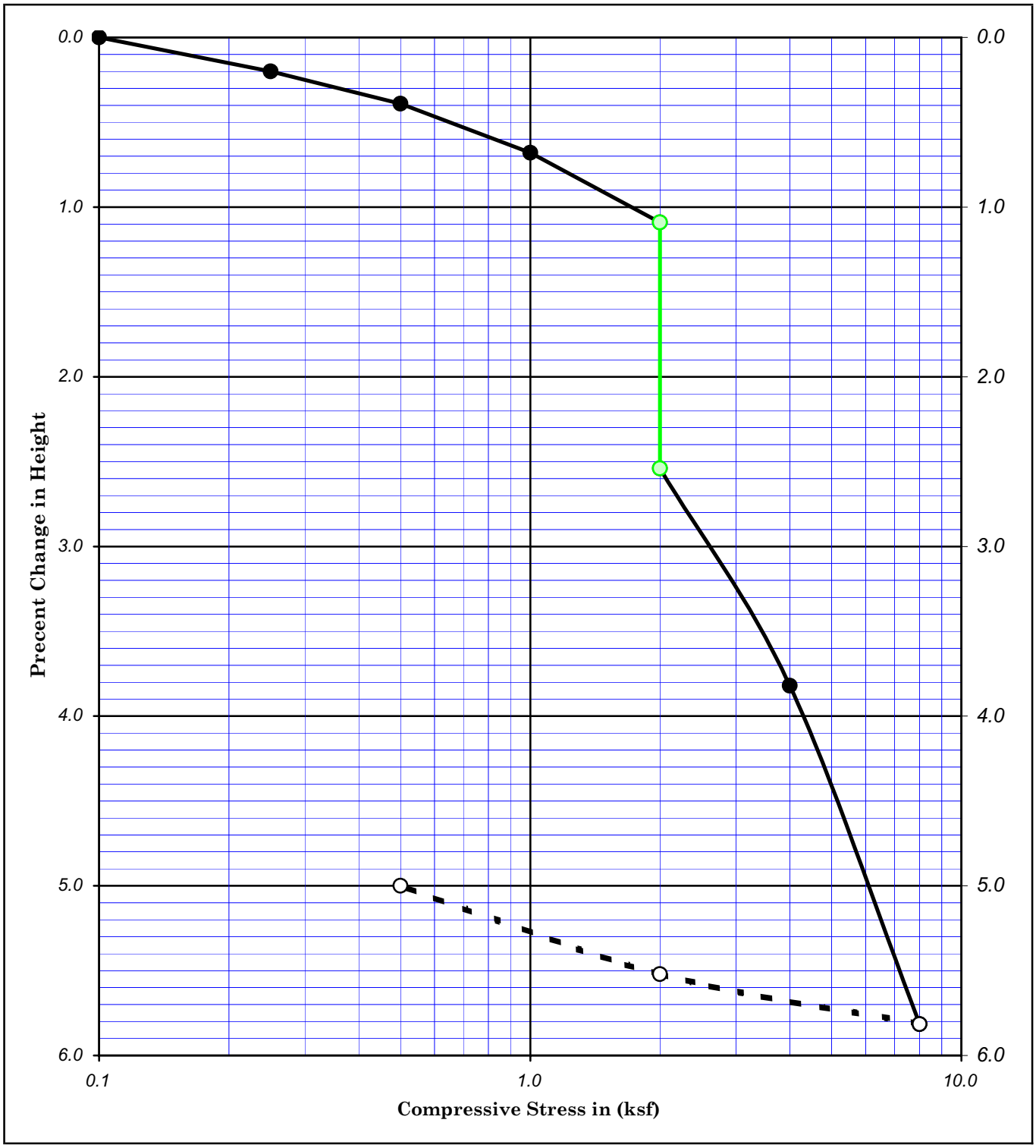
Corrosivity testing included performing soil pH (Caltrans method 643), water-soluble chlorides (Caltrans Test method 422), water-soluble sulfates (Caltrans Test Method 417) and electrical resistivity (Caltrans Test method 532). The test results are summarized in Table B-1.

Table B-1
Summary of Laboratory Testing

Boring Number	Sample Depth (feet)	pH	Soluble Sulfates (ppm)	Soluble Chlorides (ppm)	Minimum Resistivity (ohm-cm)	R-Value
B-1	0-5	-	-	-	-	55
B-2	0-5	8.9	62	53	2554	-
B-3	0-5	8.0	74	54	2856	-
B-4	0-5	-	-	-	-	64

B.8 List of Figures

Figures B-1 through B-3 Collapse Potential Tests



Boring No. :	B - 2		Liquid Limit :	-		Moisture Content (%)	Dry Density (pcf)	Dry Density (kN/m³)	Percent Saturation	Void Ratio
Sample No. :	D - 3		Plastic Limit :	-						
Depth (ft) :	6.0	7.5	Plastic Index :	-	Initial	4.32	107.88	16.98	20.75	1.58
Depth (m) :	1.83	2.29	Specific Gravity :	2.70	Final	19.78	114.61	18.04	100.00	1.48

Description : *Olive Brown, Silty Sand (SM)*

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20th Street Bridge at Amargosa Creek

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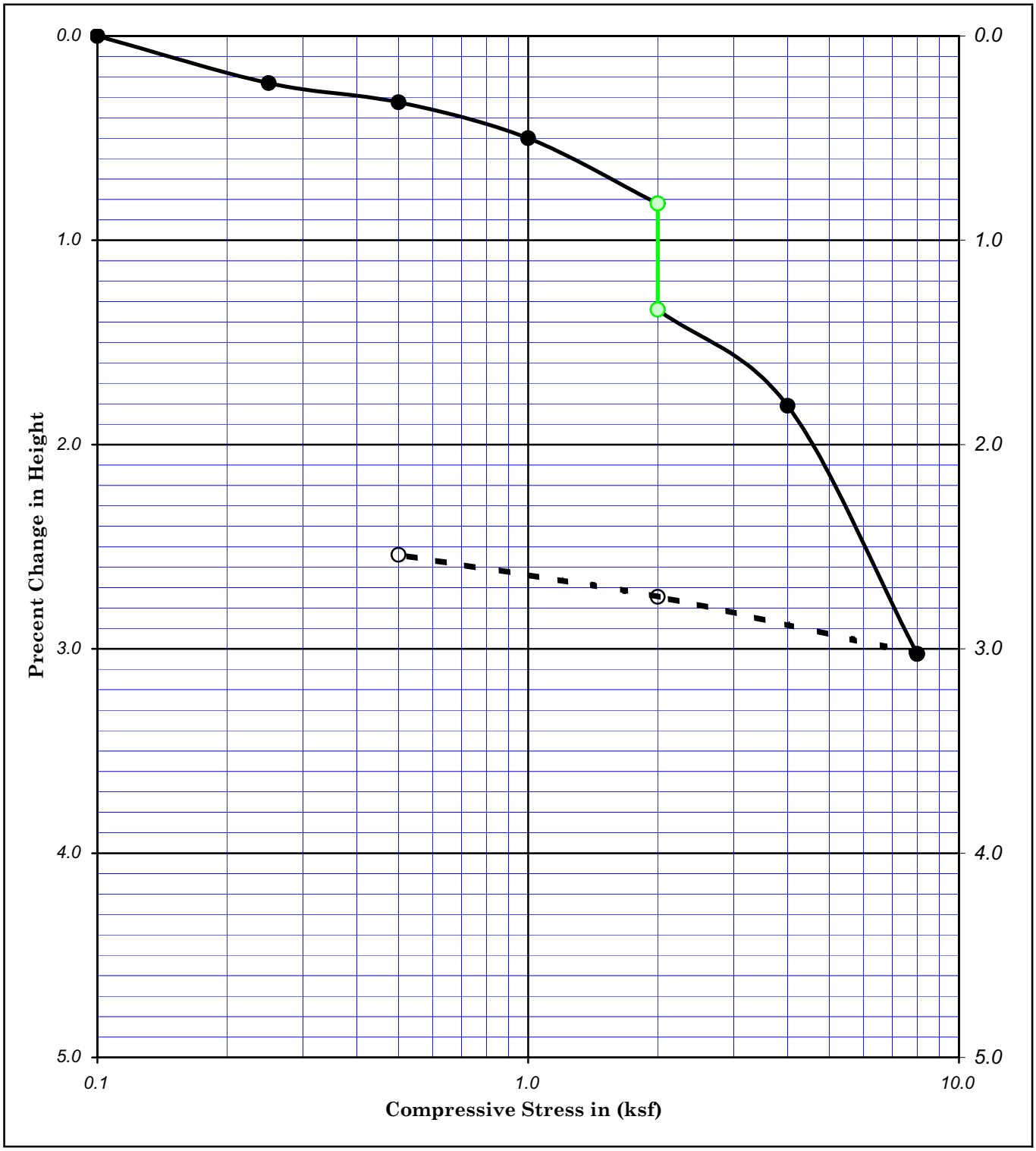
COLLAPSE POTENTIAL OF SOILS

ASTM D-5333-03

Figure B-1



Boring No. :	B - 2		Liquid Limit :	-		Moisture Content (%)	Dry Density (pcf)	Dry Density (kN/m³)	Percent Saturation	Void Ratio
Sample No. :	D - 5		Plastic Limit :	-						
Depth (ft) :	15.0	16.5	Plastic Index :	-	Initial	1.70	104.02	16.37	7.38	1.64
Depth (m) :	4.58	5.03	Specific Gravity :	2.70	Final	21.87	107.73	16.96	100.00	1.58

Description : *Light Olive Brown, Poorly-Graded Sand (SP)*

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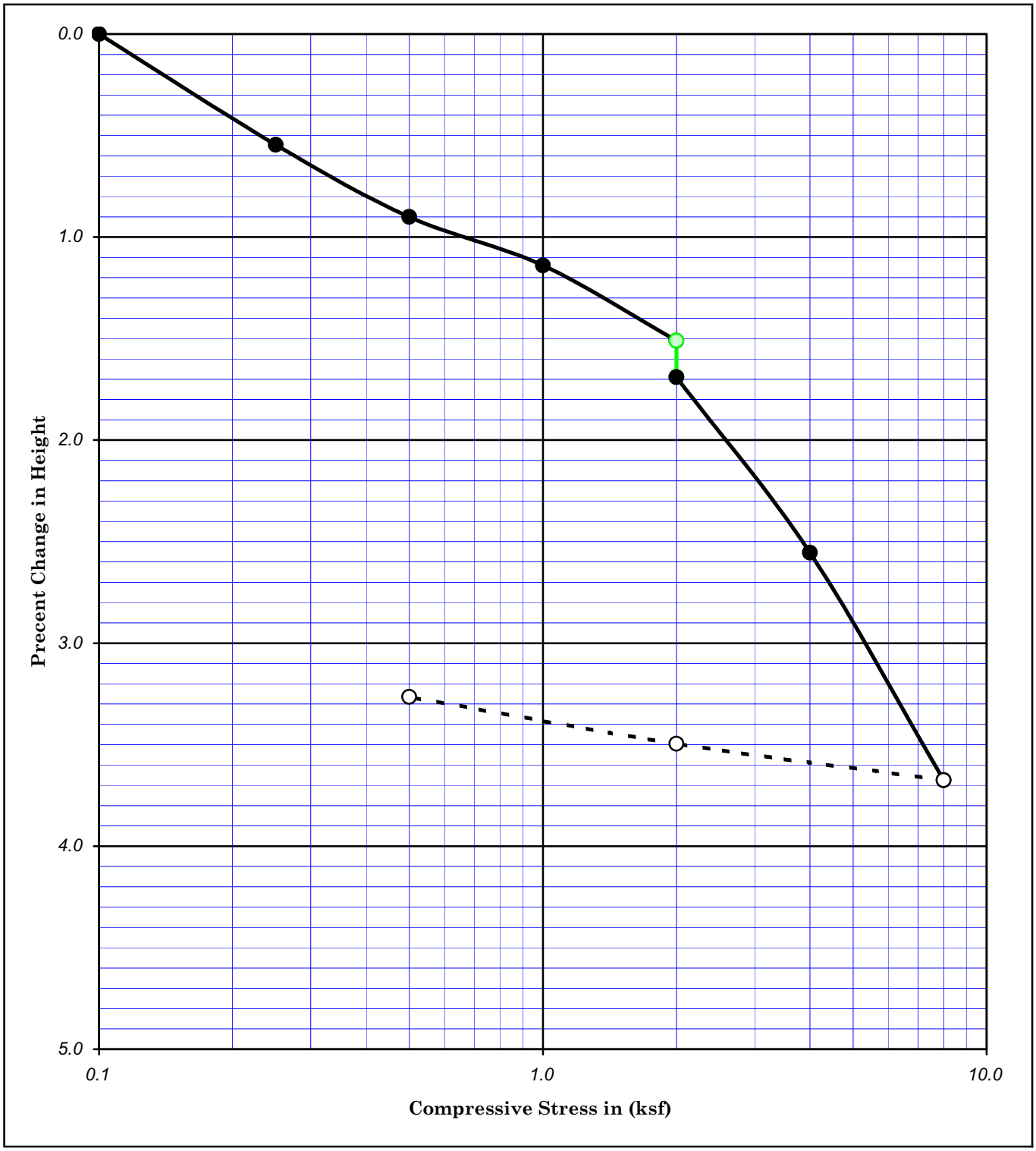
20th Street Bridge at Amargosa Creek

Project No. : *I - 380* **Date :** *12/29/05*

COLLAPSE POTENTIAL OF SOILS

ASTM D-5333-03

Figure B-2



Boring No. :	B - 2		Liquid Limit :	-		Moisture Content (%)	Dry Density (pcf)	Dry Density (kN/m³)	Percent Saturation	Void Ratio
Sample No. :	D - 7		Plastic Limit :	-						
Depth (ft) :	25.0	26.5	Plastic Index :	-	Initial	2.47	115.23	18.14	14.38	1.48
Depth (m) :	7.63	8.08	Specific Gravity :	2.70	Final	17.26	120.06	18.90	100.00	1.42

Description : *Olive Brown, Poorly-Graded Gravel with Sand and Silt (GP-GM)*

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20th Street Bridge at Amargosa Creek

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COLLAPSE POTENTIAL OF SOILS

ASTM D-5333-03

Figure B-3